1999-06

Usability evaluation of the aviation command safety assessment Web-based questionnaire

Williams, Thomas G.

Monterey, California: Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

USABILITY EVALUATION OF THE AVIATION COMMAND SAFETY ASSESSMENT WEB-BASED QUESTIONNAIRE

by

Thomas G. Williams

June 1999

Thesis Advisor: Anthony Ciavarelli

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 1999	Master's Thesis

4. TITLE AND SUBTITLE USABILITY EVALUATION OF THE AVIATION COMMAND SAFETY ASSESSMENT WEB-BASED QUESTIONNAIRE

5. FUNDING NUMBERS

6. AUTHOR(S)
Williams, Thomas George

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Postgraduate School
Monterey, CA 93943-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE: A

13. ABSTRACT *(maximum 200 words)*

Computer software has taken an increasingly larger role in the U.S. Navy. It is used in nearly every facet on naval operations, from administrative chores to controlling complex weapons systems. Because the high cost of software and the potential for inadvertent misuse, it is important that software be easy to use and understand. This thesis explores the methods and techniques available for conducting software usability evaluations. Using what described in this thesis, actual software usability testing is done on a recently developed Web site. The Web site [http://spitfire.avsafety.nps.navy.mil] evaluated in this study is designed to allow aviation units to complete a safety survey online. This thesis describes the usability test conducted on the Aviation Command Safety Assessment (ACSA) Web site and establishes a methodology that can be used on any future Navy Web site. The results of this usability test show that improvement can be made to the interface design and presentation of Web site material.

14. SUBJECT TERMS
Human Computer Interface, Interface Design, Internet, Web site design, Web Site Survey, World Wide Web, Usability, Usability Guidelines.

15. NUMBER OF PAGES
122

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

Approved for public release; distribution is unlimited

USABILITY EVALUATION OF THE AVIATION COMMAND SAFETY ASSESSMENT WEB-BASED QUESTIONNAIRE

Thomas G. Williams
Lieutenant Commander, United States Navy
B.S., University of the State of New York, 1986

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
JUNE 1999

Author: [redacted]
Thomas G. Williams

Approved by: [redacted]
Anthony P. Ciavarelli, Thesis Advisor

[redacted]
Kishore Sengupta, Associate Advisor

[redacted]
Reuben T. Harris, Chairman
Department of Systems Management

ABSTRACT

Computer software has taken an increasingly larger role in the U.S. Navy. It is used in nearly every facet of naval operations, from administrative chores to controlling complex weapons systems. Because of the high cost of software and the potential for inadvertent misuse, it is important that software be easy to use and understand. This thesis explores the methods and techniques available for conducting software usability evaluations. Using what described in this thesis, actual software usability testing is done on a recently developed Web site. The Web site [http://spitfire.avsafety.nps.navy.mil] evaluated in this study is designed to allow aviation units to complete a safety survey online. This thesis describes the usability test conducted on the Aviation Command Safety Assessment (ACSA) Web site and establishes a methodology that can be used on any future Navy Web site. The results of this usability test show that improvement can be made to the interface design and presentation of material.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENT

In Memory of Donald Robert Rees

I give thanks to God, family and friends for my life is truly blessed. A special thanks to my patient and loving wife, Susan, who has been a great source of strength, support, and encouragement throughout this entire process. Without her support my education would not have been completed. Thanks to my children, Katelin and Andrew, both of whom who showed me everyday what excellent students they are.

Thanks also to Dr. Tony Ciavarelli for giving me the opportunity to complete my thesis under his expert guidance. A special thank you to LT Mitch Stubblefield for being there when I asked, and for immeasurable patience in enduring my many questions.

Finally, I would like to thank the Navy for allowing me to come to the Naval Postgraduate School to pursue and obtain my Master's Degree. I am eternally grateful to each and everyone. Thank you.

I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to develop and apply a methodology that can be used to assess the usability of a Web-based user Interface for administering the Aviation Command Safety Assessment (ACSA) Survey questionnaire via Internet Technology. This questionnaire is needed to support the School of Aviation Safety in applying a methodology for assessing the effectiveness of Naval organizations in the management of risks associated with flight operations.

In April 1996, Commander Naval Air Pacific chartered an Aviation Safety Quality Management Board (QMB) to explore ways in which the Naval aviation mishap rate might be lowered. In order to establish a baseline analysis of the "safety climate" at the squadron level, Dr. Anthony Ciavarelli was appointed as the principal investigator for the Aviation Safety Command Survey. He developed a command safety assessment questionnaire that was distributed to 69 squadrons in the fall of 1996. The results of this initial survey provided valuable insight into the safety climate of squadrons, wings, and Type Commanders and Naval aviation as a whole. The process for completing this survey was a paper questionnaire, with submissions being returned on a form that could be read by a scanner. Distributing, administering, collecting and then analyzing these surveys was an expensive, time consuming and labor-intensive effort.

In March 1999, an internet-based, prototype model for administering this survey using new technologies that allowed automated survey submission and analysis was

by two Naval Postgraduate students (Held and Mingo, 1999). The results of their thesis is a web site [http://spitefire.avsafety.nps.navy.mil] that adheres to a three-tier client/server architecture.

Experience has shown that the value of computer systems, including web sites is directly tied to their usability. Therefore, this thesis will develop guidelines for building Web sites which focus on building a human-computer-interface that satisfies ease of use standards.

B. OBJECTIVE

In order to achieve the stated purpose of this thesis three specific objectives were accomplished. First, a selected review of the related literature on Web site design and usability evaluation was conducted. This literature review yielded an understanding of the most effective and insightful methods for usability engineering for the web. Second, using the knowledge from the literature review, a methodology was developed for usability testing and applied to the Aviation Command Safety Assessment (ACSA) Survey Web site. In addition to the formal investigation of usability, input from aviation safety officers who used the web survey was solicited. Finally, the results of the usability evaluation were analyzed and summarized in order to capture the benefits of this study for future web development.

C. PROBLEM STATEMENT

As previously indicated, Held and Mingo spent at least a year and several thousand dollars in development and implementation of the Aviation Command Safety

Assessment (ACSA) Survey Web site. This effort does not guarantee that a successful Web site for completing the survey has been produced. No matter how good the Web site looks, if the intended user has difficulty using the Web site, then the value is minimized. Over time, common flaws associated with poor human-computer interface (HCI) design have been identified. Some of the most prevalent problems involve screen presentation formats and navigation between various screens (Gillespie, 1998). Poor design also results from a failure, on the part of the HCI, to reflect the form and level of user guidance considered most appropriate. If the HCI is poorly designed, then the potential exists for the ultimate user of the Web site to reject it simply because it is too difficult to use. To avoid this possibility it is important to determine what, if any, ease of use problems may exist in the Aviation Command Safety Assessment (ACSA) Survey Web site interface design. This determination relies on ascertaining and applying a method of usability evaluation that answer such questions as:

- Are the instructions easy to read and understand?
- Does the arrangement of information on the screen make sense?
- Are users able to quickly learn how to complete the survey?
- Is navigation within the Web site easy to accomplish?
- Are the selection of colors, icons and graphics intuitive?

By investigating these and other questions, this study provides a preliminary indication of the success or failure of the Aviation Command Safety Assessment (ACSA) Survey Web site and potential improvements that may be made to the program.

D. SCOPE AND LIMITATIONS

It is not the intent of this research to provide an in-depth study of the Aviation Command Safety Assessment (ACSA) Survey questionnaire, or the actual development of the Aviation Command Safety Assessment (ACSA) Web site. Prior studies, specifically Ciavarelli and Figlock, et. al, (1996), contain substantial coverage of these subjects and web site development has been completed by Held and Mingo (1999). Furthermore, the limitations and computer hardware requirements needed to administer and access the web site are well documented in these publications and will not be discussed here. The focus of this study is the Aviation Command Safety Assessment (ACSA) Web site design, or more specifically, the interface provided by the software as it is run on a typical personal computer.

E. THESIS ORGANIZATION

This thesis consists of five chapters. Chapter II provides a review of selected literature pertinent to web site design, software usability and usability testing. Chapter III covers the methodology behind the data collection and Chapter IV, the analysis of the data collected. The remaining chapter, Chapter V, provides the conclusion and recommendations. The questionnaire, interview transcripts and other items significant to this study are attached as appendices.

II. BACKGROUND

Building a medium or large World Wide Web site, whether for distribution over the Internet or over an Intranet, can and should be viewed as a major software development effort. Applications on the Web range from having users complete simple tasks, such as filling in a form, to more complex undertakings, such as collaborating on a project.

The tools available for creating Web pages allow anyone to design a Web application. But the Web--unlike Windows, Macintosh, and Unix--has no standards for designing applications. People come to the Web with expectations based on using the other platforms, and these expectations make up their conceptual model of using an application on the Web.

Frequently, in Web applications users get lost because the model of navigation on the Web differs from that in other applications. This difference causes confusion among users, but application developers can use a few techniques to help people successfully use the application.

Once Web site creation is seen as software development, it becomes natural to apply the tools and methods we have learned in past projects. The life cycle of Web creation is identical to that of traditional software: requirements gathering, analysis, design, implementation, testing, and deployment. And, just as traditional software development should have a functionality and a usability component, so should Web development efforts.

A. WHAT IS USABILITY?

Usability can be defined as the degree to which a given piece of software assists the person sitting at the keyboard to accomplish a task, as opposed to becoming an additional impediment to such accomplishment. The broad goal of usable systems is often assessed using several criteria:

- Ease of learning.
- Retention of learning over time.
- Speed of task completion.
- Error rate.
- Subjective user satisfaction.

Methodologies for building usable systems have been introduced and refined over the past fifteen or so years under the discipline of Human-Computer Interaction (HCI). HCI principles include an early and consistent focus on end users and their tasks, empirical measurements of system usage, and iterative development. Much effort has been put into exploring cognitive models of human behavior as it relates to computer usage, and developing guidelines for screen layout and system dialogues. These are predictive endeavors whose purpose is to assist the software developer in the initial task analysis and system design.

But, just as comprehensive functional requirements and a detailed design document do not by themselves guarantee that a programmer's final code will be correct, so up-front usability guidelines do not by themselves guarantee a usable end product. In both cases a distinct validation process is required.

Usability engineering techniques can create more usable Web sites by helping developers focus on the users rather than the technology. Understanding users' needs and the tasks they are trying to accomplish is steadily becoming more important than adopting the latest whiz-bang feature. Of course, if the latest technology fulfills a need, it should be used; but incorporating this technology just to be cool is becoming less and less acceptable.

Improving usability is not a black art: it can be accomplished by heeding common sense advice and applying techniques that help us understand and meet the needs of users. A good introduction to this topic is Jakob Nielsen's Usability Engineering (Nielsen 1994). Applying usability engineering to the Web is not that difficult, although the Web does introduce a few interesting problems--and solutions. Darrell Sano's Designing Large-Scale Web Sites (Sano 1996) discusses many Web usability issues, such as limitations and constraints for Web publishing and structuring the information space.

What follows is a review of usability techniques and methods, seen in light of the constraints and tradeoffs of the World Wide Web. The best place to see usability engineering applied to the Web is the Sun-on-Net project (Nielsen 1997c), where usability testing, iterative design, and other activities improve the usability of Sun's Web site.

B. INTERFACE DESIGN CONSIDERATIONS

1. Reading on the World Wide Web

In order to design interfaces geared toward Web based clients one must first study

how users read from that medium. According to the Nielsen Norman Group, "User experience" encompasses all aspects of the end-user's interaction with the organization, its services, and its products.

> The first requirement for an exemplary user experience is to meet the exact needs of the customer, without fuss or bother. Next comes simplicity and elegance that produce products that are a joy to own, a joy to use. True user experience goes far beyond giving customers what they say they want, or providing checklist features. In order to achieve high-quality user experience in a company's offerings there must be a seamless merging of the services of multiple disciplines, including engineering, marketing, graphical and industrial design, and interface design. (Nielsen Norman Group http://www.nngroup.com/about/ userexperience.html, February 22, 1999).

These statements can easily be applied to any government scenario, where the customer is analogous to any user of an organization's Web site and references to the company equate to the organization using a Web site for constructive purposes.

A study conducted by John Morkes and Jakob Nielsen found that 79 percent of test users scanned and new page they came across, with only 16 percent reading word-for-word (Nielsen, 1997a). Four possible reasons for this particular behavior are (Nielsen, 1997b):

- Reading from computer screens is tiring and approximately 25 percent slower than reading from paper;
- The Web is a user-driven medium, i.e. users feel they must move on and click on things;
- Each page has to compete with literally millions of other pages for the user's attention;
- Modern life is hectic.

According to research by Nielsen and others, individuals do not want to invest too much time in any one page while searching for information on the Web because the page may

not contain the needed information. Thus, the page is quickly scanned for relevance in a quick once over before clicking on the next page.

Other important issues are the credibility of the information, since there is no guarantee about who has provided the information posted to the Web site. Studies by Nielsen have shown that by providing hypertext links to external related sites, using high quality graphics, and employment of good writing practices, credibility or perceived credibility of the information on a site can be significantly increased.

2. Writing for the World Wide Web

By understanding how users interface with and read on the Web, insight can be grained into methods of effective writing for the Web. Information should be presented in a concise and intuitive format (Gahran, 1998a). Keep pieces short, by breaking up if plausible and following these guidelines (Gahran, 1998b):

- Pare down whatever you are saying to the greatest extent that is appropriate. Consider using bulleted lists and highlighted key words.
- Make sure every bit of content has a point that will matter to the user, and make those points obvious.
- Break up longer stretches of text into manageable "chunks".
- Attempt to predict and answer all the major natural questions that your users will probably have about your organization or your site's content. Consider dropping any content that does not focus on what the user probably wants to know.

Writing for the Web is more akin to newspaper journalism than to any other form of distributing information, including marketing publications, magazine articles, books or theses. In the newspaper format, the summary or conclusions of the story are at the front of the story. This is done in order to immediately capture and retain the reader's attention.

If the reader these lines and is interest in the topic, they will read the entire article and be able to retrieve details. This is done in order to immediately capture and retain the reader's attention. If the reader reads these lines and is interested in the topic, they will read the entire article to retrieve details. This is especially true for the front page in the area known as "above the fold." This prime real estate must be used to full advantage to make the sale by hooking the potential customer with interesting facts in order to entice them to purchase the paper. In the same vein, each Web page on a site must make promise of the information contained therein, as well as in the lower "drill-down" layers. The most sought after information should be summarized or encapsulated at the top of the page, in the writing style described above. The user will scan this page and determine if it contains the information needed, and read further or drill-down for more details. Nielsen (1996a) refers to this type of writing as the inverted pyramid style. This allows the page creator to identify the purpose of the site near the top of the page so the reader can easily see if they want to invest time at that site.

Creating hyperlinks in text serves to highlight that text and to provide a place so the user can dill-down to obtain more information, as desired. This is one of the most powerful features of the Web, and this is what creates the "webbing" effect of the Internet. This allows Web writers to split their writing into smaller, coherent pieces to avoid long scrolling pages (Nielsen, 1996b).

C. WEB USABILITY ENGINEERING LIFE CYCLE

The usability engineering life cycle (see the following list Nielsen 1994) represents a menu of choices that can be worked into the broader development context in

order to increase usability. The techniques focus on understanding users, promoting usable designs, finding usability problems, and understanding other constraints in development.

1. Know the user.
2. Competitive analysis.
3. Setting usability goals.
4. Parallel design.
5. Participatory design.
6. Coordinated design of the total interface.
7. Applying guidelines and heuristic analysis.
8. Prototyping.
9. Empirical testing.
10. Iterative design.
11. Collecting feedback from field use.

Steps 1, 7, 10 and 11 (Know the user, Applying guidelines and heuristic analysis, Iterative design, and Collecting feedback from field use) are most pertinent to Web usability and are elaborated upon in the sections that follow.

1. Know the User

The most basic of usability guidelines, "know the user," can be very difficult on the Web, where international access, exponential growth, and wide-ranging demographics (from school-age children to elderly citizens) are the norm. It is also difficult to understand what people really want from this new medium, in which so much is possible. The many

surveys of general Internet demographics will provide some information on "who is out there," but talking to users is still the best way to get a handle on user-specific usability problems.

On the Web, "know the user" also means knowing the speed of their Internet connection, which browser version they are using, what plug-ins they have, and so on. Understanding these factors plays a big part in choosing advanced Web technologies and determining when they can be safely introduced.

2. Applying Guidelines and Heuristic Analysis

Many usability problems can be avoided by following the published guidelines (Nielsen, 1996c) and by adhering to some general rules of thumb (see the Heuristics section below). Since the guidelines and heuristics are very general, additional usability techniques, such as empirical testing, are needed to determine the best solution for each particular problem.

3. Iterative Design

Iterative design involves a four-step process:

- Creating something.
- Testing it out with users.
- Understand the strengths and weaknesses.
- Designing a better version.

This fits very well into the Web "culture," in which a site does not have to be perfect the first time and the technology is constantly changing. Iterative design works best if it is part of the overall Web management process rather than an extra chore

performed every year or so. Between iterations, one should be gathering user feedback, analyzing log data, creating rapid prototypes, and testing users.

Part of the iterative design should also be an evaluation of new technologies for the next version. Such a technology should not drive the change but rather be seen as a solution to known usability problems.

4. Collecting Feedback from Field Use

One of the easiest and most effective ways to improve the usability of a Web site is to see what real users do with it. A strength of the Internet is the ease with which the users can provide feedback. A common practice is to place mail to and feedback buttons on every page, encouraging users to take a moment to send the developers a note if they have a problem, a complaint, or some praise. The best user feedback can be designed into the site transparently.

Good logging of Web site usage is important for those who have to justify the cost of developing and supporting a site. As far as improving usability, logs can also indicate how people access the site, what problems they are having, and how a redesign affects usage.

D. HEURISTICS

Heuristic evaluation is one of the most important aspects of usability engineering: it is easy, fast, and inexpensive. It involves study of a user interface by a small set of evaluators for violations of common usability principles (rules of thumb, heuristics) so that the next iterative design can try to solve the usability problems. See the list that follows for some of the common usability heuristics (Nielsen 1994).

- Simple and natural dialog.
- Speak the users' language.
- Minimize the users' memory load.
- Consistency.
- Feedback.
- Clearly marked exits.
- Shortcuts.
- Good error messages.
- Prevent errors.
- Help and documentation.

Heuristic evaluation is well suited to the Web, where everyone is in a hurry and the site can be evaluated from half-way around the world. When doing a heuristic evaluation for the Web, the common heuristics of consistency, feedback, and so on apply. But a few other rules of thumb are also useful when evaluating a Web user interface.

1. User Control

Because of the Web's architecture, in which browsers are responsible for interpreting HyperText Markup Language (HTML), developers never really know who--or what--will be processing their pages. Forcing users into particular fonts, sizes, colors, screen widths, or browser versions will generally reduce usability. Of course, designers need to have some control. But the more general the implementations and designs, the more likely we will reach satisfactory levels of usability for the widest range of users and over the longest periods of time.

Emerging Web technologies should often be avoided because they fail on this user control heuristic early in their life spans. One example is animation. To accommodate a diverse set of situations, users should be allowed to start and stop animation on their own. On one hand, animations that repeat forever are distracting; on the other, those that cannot be repeated lose their value. Until users gain adequate control over this technology on the Web, animations should be used very carefully. (Even once user control is in place, animation should be used only when appropriate (Nielsen 1995).

A new Web feature that will enable greater user control is cascading style sheets (Andrews 1996). Style sheets force the developer to separate the presentation aspects of the page from the content, making it easier for a user to "intercept" the presentation information and insert his or her own requirements for display. Beyond selecting link color, for example, style sheets will extend the amount of control users have to include many other items of personal taste. The largest gain, however, will be that users can specify style attributes in a standard way to ensure their own personal requirements for usable access. For example, users with poor eyesight could specify large font sizes for headers and text, overriding the font sizes specified by the authors.

When evaluating a site for user control, the following questions can be asked to determine what usability problem might arise:

- Can users override this feature?
- Can they customize to suit their tastes or needs?
- Will giving users control of this feature reduce the usability of the site?

2. Structure

In all hypermedia systems, some underlying structure is important to help users figure out where they are and where they can go next. On the Web, where search engines and links from other places can throw users into the middle of any site, showing this structure is even more important. Since Web browsers lack substantial navigation aids to help users discover this structure, Web authors have to do a lot of this work themselves. To evaluate structure, one can look at every major page of a site and ask the following questions:

- If a user were taken directly to this page from an outside site, what could they figure out about the rest of the site from this one page?
- Is the site "brand" present?
- Is it clear which part of the site they are in?
- Is it clear how to navigate to other parts of the site?

3. Design for Change

The Web is about change, so a user interface had better be able to deal with both continually changing content and design. The evaluator can ask the following questions:

- How is old content archived?
- How is new content added?
- Can this design withstand the addition of 20 times the current content?

If everything has to be introduced through a "What's new" page, the site was not properly designed for changing content. If iterative design is going to work well, the design has to be flexible enough to withstand small changes without having to be thrown away. For example, if user feedback indicates a need for an additional major section to a Web site, can the design handle it, or would the site have to be redone from scratch? If improving the usability is too difficult, it simply will not happen.

E. USABILITY TRADEOFFS

Usable interface design involves tradeoffs: weighing the costs and benefits to develop the best solution under the current conditions. The Web requires some very serious tradeoff decisions because of its low bandwidth, the role of browsers, and the existence of standards.

It is important to note that these tradeoffs are not meant to mandate one decision over another. What is important is to understand the pros and cons in order to make an informed decision. Sometimes usability has to be sacrificed because of cost, time, or management issues, but blindly adopting a new Web technology rather than studying the usability tradeoffs is not appropriate.

For example, third generation site design (Lie 1996) improves usability by providing better page layout: paragraphs are indented, headers are close to their associated paragraphs, and there are left margins. One of the costs, however, is that access with graphic loading turned off (to speed the process) presents a significantly less usable site; the precisely aligned text is no more, and "unloaded graphics" icons litter the screen.

So if one is willing to eliminate use by one segment of the Internet population, a third-generation site might be appropriate. (Note also that several other populations of users are disenfranchised by third-generation site design such as those who have disabilities Paciello 1997). Part of the tradeoff is found in the answers to the following questions: is this a very usable site for a few users, a fairly usable site for the majority of users, or a "good enough" site for all users?

1. Bandwidth

Access speed is currently one of the major constraints on design. The best design, no matter how good, will not be seen if it takes too long to download. Until access speed is no longer a major problem, tradeoffs involving the quality of the graphics, the complexity of the design, and the use of higher bandwidth advanced technologies will be important to understand in creating usable Web sites. In addition, developers would benefit from observing users at very slow speeds.

Web site developers must be cognizant of download times and design accordingly. According to a newspaper article for the Seattle Times Web site (Williams, 1998) here is a wish list for Web users to Web designers:

- Create pages that appear on the screen quickly. Do not load them up with big graphics.
- Do not start sound files running without asking if it is wanted first.
- No blinking, animated graphics, or dancing objects.
- Make navigation easy. Keep the buttons in the same place as you move through the site. Those buttons and icons should be logical and labeled.

Graphics and images are usually the largest part of any Web page, and as such they tend to use up the most bandwidth. Omitting some or all graphics from a page is the quickest and easiest way to decrease download time of a Web page, although some smaller, well chosen graphics may make the page more readable. Graphics to be placed on a Web page should be chosen carefully. They must add value to the information and the page is being used to convey, not just be placed there for decorative purposes. Consider that if a page contained ten 100KB images, the download amount would be over one megabyte of information. This certainly does not bode well for using a modem connection.

Another tip for designers to consider is the use of alternative or the "AL=" attribute. This allows the user to have a description of an object while it is loading into the browser. If the transfer is interrupted or "times out," the user will know if the item is something they are interested in trying harder to obtain, either by reloading the page or returning later to download it again. This also describes objects to those who have image loading turned off in their browsers, or those who have browsers that do not support images. Values set in this attribute should be a sensible description of the object they represent. There are four types of images contained on Web pages; page toys, navigation icons, supplemental or interesting, and those that are critical for understanding the page. (Flavell, 1998)

2. Standards

Standards make the World Wide Web interoperable. The most important standard for developers is HyperText Markup Language (HTML). The latest version of HTML is 4.0 (Raggett and Hertzbert 1996). HTML 4.0 has brought the major Web vendors

together, making the Web more interoperable and slowing the "tag wars" that were impeding the creation of usable Web sites across the different platforms. Knowing the HTML standard and following it when appropriate are crucial in making informed design and implementation decisions.

In general, the more meticulous we are in following the standards, the more usable a site is for the largest audience. Any variation from the standard, even if it follows "Netscape's standard," will have an effect on some part of the user population. It would help to consider the following questions:

- Is that new tag useful enough for those who can take advantage of it?
- Does it significantly affect those who cannot take advantage of it?

The best extensions are those that give added functionality for the "haves" while having no negative effect on the "have nots." A good example of this is the background color attribute for table cells. Because they are not part of the older HTML 3.2 specification, table cell background colors are ignored by those browsers that follow the standard and have not implemented this extension. Developers need to be aware that this is indeed not part of the standard and should ensure that their sites are still usable for those who do not have access to this added feature.

Developers should also be aware of cases in which browsers are "forgiving"--i.e., those that create usable layouts of nonstandard HTML. For example, images are not allowed in PRE sections according to the HTML specification, but most browsers will generate reasonable interpretations of such markup. Designs that rely on such nonstandard use of HTML should be carefully considered.

Designers of a corporate Intranet have it much easier than those with an Internet audience. If all users are known to have a particular browser and version, one can more safely take advantage of nonstandard aspects. Still, any nonstandard usage could tie that corporation to one particular vendor, so some intelligent decisions need to be made.

3. Browsers

Another tradeoff occurs because of the crucial role that browsers play on the Web. The browser does certain things that are out of the author's control--history, bookmarks, and exact page layout, for example. The fact that the developer has to rely on the browser to provide certain functionality may limit the creation of usable sites. One need only look at the sophisticated and easy-to-use interface on CD-ROMs today to realize the limits that browsers impose on the Web. Browsers often have bugs that make certain features unusable. Netscape Navigator's early implementation of frames had serious problems with Back and bookmarking, which made frames quite unusable. (Now those bugs are fixed and frames are more usable--but not necessarily usable enough for certain applications.) Since not everyone has the most current version of browsers, these bugs are still an issue when designing a site today. Finally, there are a lot of browsers, each acting slightly different. Developers need to test their sites on as many platforms as possible in order to ensure usability for the widest range of visitors.

F. USABILITY TESTING

Solid design and usability are features explicitly used to sell products to consumers. When we hear someone selling Windows 95™ as being "just like a Mac," or an Infiniti salesman preaching that thousands of customers were tested in order to

determine the placement of displays in Infiniti automobiles, this suggests that a payoff exists in terms of customer satisfaction and sales.

There are methods available to web designers that may not have been applied previously to legacy system design. Bellcore's User-Centered Design (UCD) methodology helps designers to rethink and redesign existing software systems to accommodate users and the web. UCD is a process for creating software that meets "documented objectives for usability and usefulness (with) an early and continuous focus on users throughout the analysis, design, and development process" (Salasoo, White, Dayton, Burkhart, and Root, 1994). It is never too late to start usability testing, but the earlier one starts, the larger the payoff in time savings and user satisfaction. A good example of how usability testing was applied to web design is presented by Jakob Nielsen and Darrell Sano (1995) who wrote about their interface design testing of the new Sun Microsystems web site.

A user-friendly web interface can have many advantages over an existing legacy interface. These advantages include:

- Reduce errors due to a redesigned.
- Increased user acceptance of the system.
- Increase flexibility for changes and improvement to the system.
- Increase number of platforms supported with a consistent interface across platforms.

G. CONCLUSION

Usability engineering techniques, such as user testing, iterative design, heuristic evaluation, and user feedback, can make Web sites easier to use. Usability evaluations of new and emerging Web technologies, such as frames, JavaScript, Java and animated GIFs

(Graphics Interchange Format), are particularly important so that the tradeoffs of incorporating them into a site can be understood. Web standards, such as HTML 4.0, provide the basis of interoperability and help to ensure that designs will remain usable over time. Although excitement about the Web is still motivating users to play with new technologies, along with the increased use of the Web for "everyday" tasks and not just for fun, indicates a trend in which "what's useful" will become more important than "what's cool." Those sites that incorporate usability engineering into their development process will find that they are better able to survive in the highly competitive marketplace of the World Wide Web.

III. METHODOLOGY

A. SUBJECTS

1. Background

Selection of participants in this research focused on potential users of the Aviation Command Safety Assessment (ACSA) Web site and consisted of aviation units from Norfolk, Virginia and San Diego, California. This focus limited the research to Helicopter Combat Support Services squadrons HC-2, HC-3 and HC-11, Light Airborne Multi-Purpose System (LAMPS) squadron HSL-45 and Airborne Early Warning (AEW) squadrons VAW-120 and VAW123. These squadrons comprised a mix of rotary and fixed wing pilots.

2. Participants

From the available pilots in the squadrons, several were asked to participate in either the General Web Survey or usability testing of Aviation Command Safety Assessment (ACSA) Survey. All test subjects elected to participate voluntarily. No individuals with specific experience in the use of computers, software or the web site design were singled out for the purpose of including or excluding them from the evaluation. All participants received an overview of the Aviation Command Safety Assessment Web site goals and objectives and an explanation of their role in the usability testing. The participants were asked to be candid in their response to the General Web site, Aviation Command Safety Assessment (ACSA) Usability Survey, and interview as their responses would be confidential.

B. INSTRUMENTATION

1. Questionnaire

A General Web Survey was given to squadron volunteers in an attempt to assess the amount of integration of computer into the lives of aviation personnel. The intent of this survey was to profile the aviation user. By determining the level of familiarity of the target group with current computer technology, a baseline can be established by determining the least common denominator. Questions in this survey were designed to be as neutral as possible to determine the true user is perspective. The five basic characteristics of questions and answers that are fundamental to a good measurement process (Fowler, 1995) are as follows:

- Questions need to be consistently understood.
- Questions need to be consistently administered or communicated to respondents.
- What constitutes an adequate answer should be consistently communicated.
- Unless measuring knowledge is the goal of the question, all respondents should have access to the information needed to answer the question accurately.
- Respondents must be willing to provide the answer called for in the question.

How to design questions to measure subjective states (Fowler, 1995):

> Because there are no standards against which to evaluate the correctness or rightness of answers, standardization of the stimulus of the question is particularly critical in measuring subjective states. For this reason, designing questions that can be administered in a consistent way and that mean the same thing to all respondents, to the extent possible, is high on the list of strategies for creating good measurement of subjective states.

> Equally important is standardizing the response task. That means clearly defining the dimension or continuum respondents are to use in their rating task and giving them a reasonable way to replace themselves, or whatever else they are rating, on that continuum.

Fowler continues, the answers that come from a subjective questions have no absolute meaning, rather they are relative. The position of the answers relative to each other is where the relevant information is found. In general, surveys should ask things that respondents are able to reliably report.

The first survey included general demographic questions about user characteristics to determine what the subjects had access too, and what they were accustom to using. There were also some questions based on a five point Lakers scale (Fowler 1995) regarding Web sites on the Internet itself, as well as questions relating to the time and amount of time spent on Web access. This survey was handed out to the participants and collected the next day.

The Aviation Command Safety Assessment (ACSA) Usability Survey was designed to ascertain input about the ACSA Web site specifically. Questions were asked after the participants had on opportunity to explore the site. The first section of this particular survey was a set of general questions about the site based on a five point Likert scale. The second part was interactive, in which participants accessed a Web page and were asked questions about the pages, they directly observed. This portion was executed on a one-on–one basis, with the pages being accessed for the individual in an attempt to standardize the exercise. Participants were not asked to go to the site and find out answers to specific questions as in the study by Morkes and Nielsen (1997) on usability.

This study concluded that by writing in concise, objective and scannable format, designers can greatly increase usability of a Web page.

In order to assure anonymity, no names were taken and the data shall be displayed on in aggregate form. Appendices A and B show the General Web survey and the ACSA Usability Survey, respectively, while raw summary data are shown for each respective survey in Chapter IV.

2. Interviews

All participants were interviewed upon completion of the Aviation Command Safety Assessment (ACSA) Usability Survey. As with the comments section of the questionnaire, the interviews were designed primarily to probe for frustration with specific parts of the ACSA. Only four questions were asked:

1. Did you find the portion of the ACSA that you used to be an easy tool for completing the survey?
2. Was there anything that you found particularly difficult to do or understand?
3. If you could change one thing about the ACSA Web site to make it easier to use, what would it be?
4. Are there any features you would like to see added to the ACSA Web site?

Significant responses to these questions are detailed in Appendix D.

C. PROCEDURES

A pretest walkthrough of log-on procedures was completed prior to the field evaluation. The walkthrough took place in several computer systems located at the Naval Aviation Safety School and reflected the usability test as planned for the actual testing of the ACSA Web site. Participants for this phase were staff volunteers representing typical

end users in the fleet. During the pretest walkthrough, questions to log-on procedures and interview questions were refined.

The first usability test of the Aviation Command Safety Assessment was done at HC-11 San Diego, California. The volunteer participants were given a brief presentation on the ACSA Web site and an explanation of what was desired from them during the test (Appendix C). It was expressly noted to each participant that they were not the subject of the research but were only assisting in the evaluation of the ACSA Web site. After the presentation the subjects were scheduled to use the ACSA Web site so not to interfere with their other daily tasks.

Prior to beginning each individual session the participants were familiarized with the log-on procedures (Appendix B). The previous instructions were reiterated and the desire that the participants talk aloud during the session and point to the screen to indicate problems was stated. Participants were then instructed to proceed reviewing the Web site using the ACSA Usability Survey as a guide. Total time to complete the test was noted so that a basis for future tests could be established.

D. ANALYSIS STRATEGY

Descriptive statistics were used to examine the data from the questionnaire. The number and percentage of subjects who answered a question in a specific way is shown in a frequency table and illustrated with a bar graph. The number of participants in the test were used as a base for calculating the percentages. The mean, median and standard deviation were also calculated for the answers to each question. All tabulation and calculations were accomplished using Microsoft Excel spreadsheet software.

Significant comments, taken from the open ended portion of the questionnaires and interviews, are quoted in Appendices D and E respectively.

IV. RESULTS AND DISCUSSION

A. DATA ANALYSIS

The author conducted a survey of the aviation participants as described in the "survey Methodology" section of Chapter III of this thesis. The survey was conducted at each aviation squadron's command as noted early. The survey was deemed to be self-explanatory, but the author was available to answer any questions. An early question concerned the meaning of intuitive. As found in Webster's New World Dictionary, *intuitive* is defined as of, pertaining to, or arising from *intuition*; with intuition being the act or faculty of knowing without the use of use of rational processes; immediate cognition. Participants returned fourteen of the fourteen surveys given out.

The findings presented in this section have been taken from the General Web Survey and Aviation Command Safety Assessment (ACSA) Usability Survey and interviews with the participants.

The responses to the questionnaires were transferred to a Microsoft Excel spreadsheet (Appendices E and F respectively) and simple descriptive statistics were computed from the questions that used Likert scales. The resulting data were converted to tables and figures. Responses to the non-scaled questions were reviewed for any significant differences or similarities among the respondents.

Like the responses to the non-scaled questions of the questionnaire, responses to interviews questions (Appendix D) were examined for trends indicating problems or frustrations experienced across participants.

B. FINDINGS

1. General Web Survey

The following pages present a detail statistical and graphical breakdown of responses to each question of the questionnaire. The first five questions were used to collected a profile of the squadron user, while questions six through twenty-one focused on computer usage.

Sixty-four percent of the aviators tested in this survey indicated they spend between eight to ten hours at work per day. In addition the same percent indicated they are between twenty-five and twenty-seven years of age. Gender was not equally represented with males making up seventy-eight of the participants, however this is a good representation of a typical squadron with respect to gender. All participants indicated they are in the United States Navy with forty-two percent of them indicating a rank of Lieutenant (O3) twenty-one percent as Lieutenant Junior Grade (O2) and twenty-one percent indicating a rank of Lieutenant Commander (O4). See Figures 4.1 through 4.5 for a detailed statistical and graphical breakdown of responses to each question of the questionnaire.

Question 1.1: How many hours per day, on average do you spend at work?

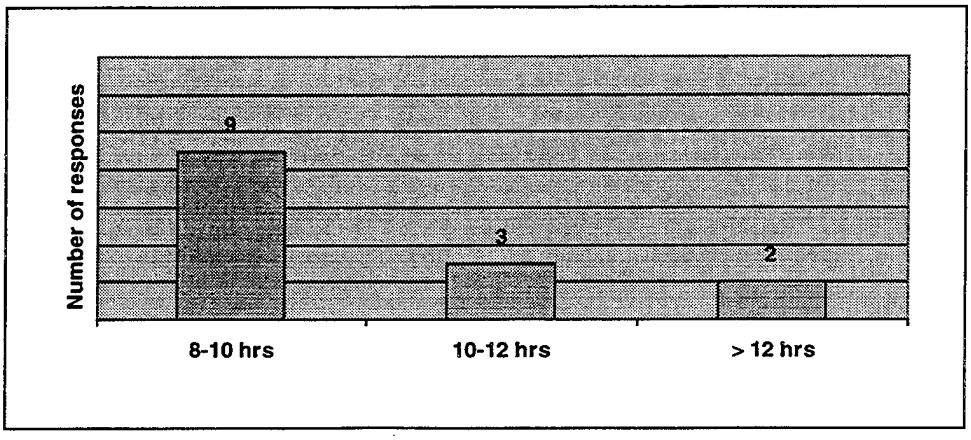

Figure 4.1. Hours worked

Question 1.2: What is your age?

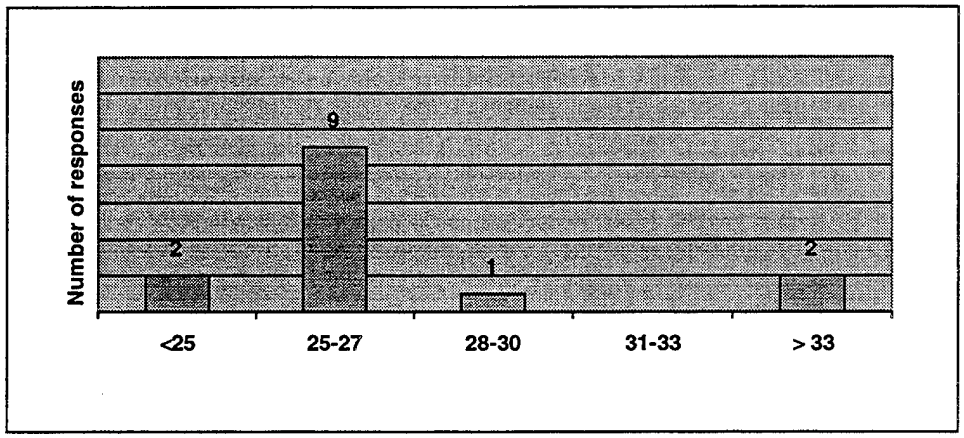

Figure 4.2. Age

Question 1.3: What is your sex?

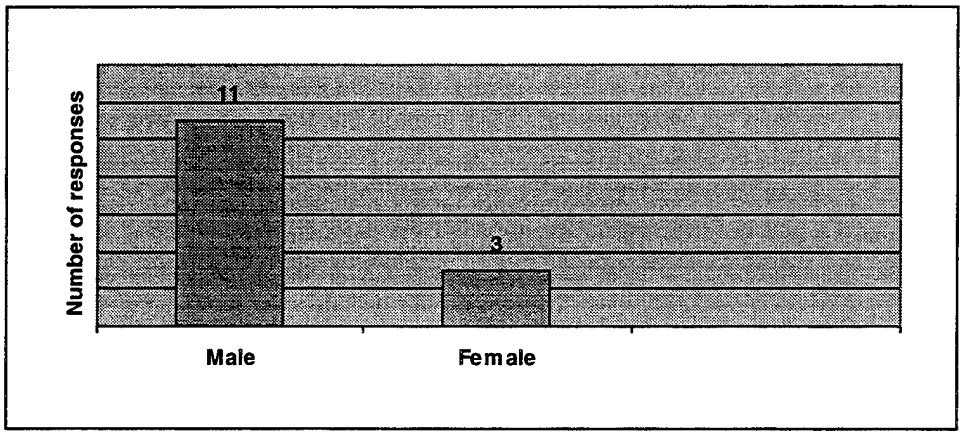

Figure 4.3. Sex

Question 1.4: What is your branch of service?

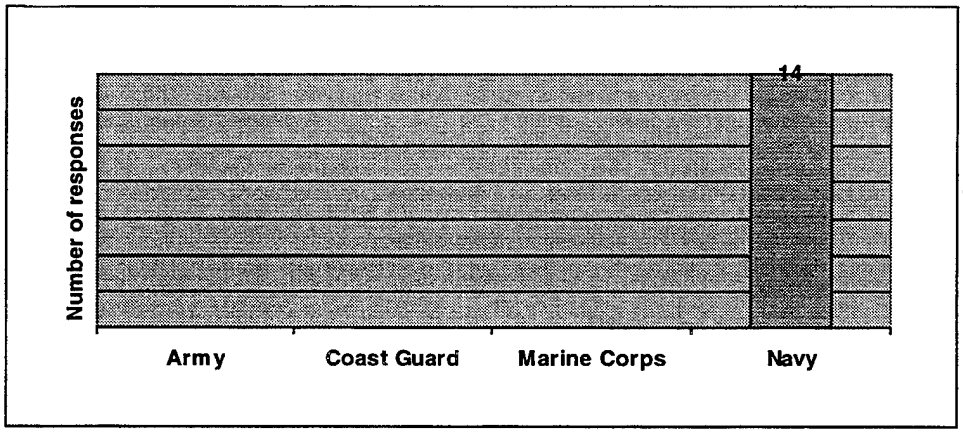

Figure 4.4. Branch of Service

Question 1.5: What is your pay grade?

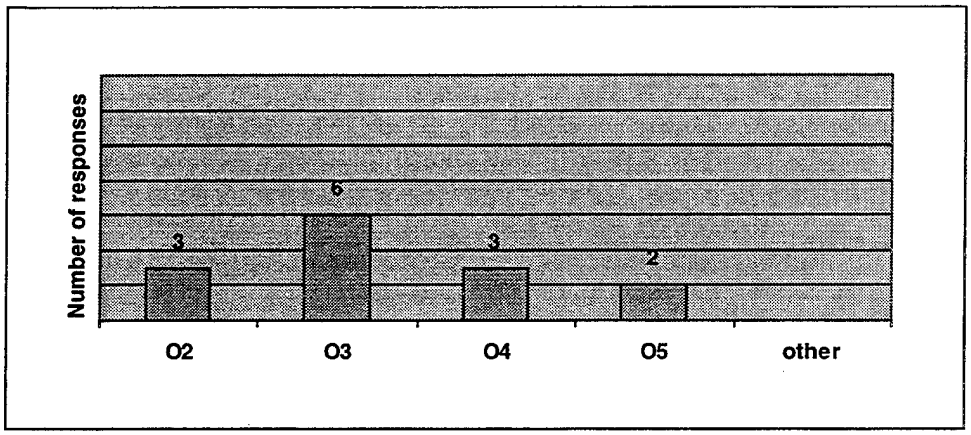

Figure 4.5. Pay grade

All of the respondents indicated using a computer at home, with fifty percent doing so at work and thirty percent using a mobile computer. All reported using personal computers (PCs), twenty-one percent use a Macintosh, and twenty-eight use a notebook computer. Seventy percent use Windows 95/98™, with fifty percent indicating then use Microsoft Office 95/97. Browsers use was split evenly with fifty percent using either Microsoft Internet Explorer or Netscape. Obviously some of the respondents use two different browsers, but obtaining preference was not the goal of this question. See Figures 4.6 and 4.7 for a graphical breakdown of responses to each question of the questionnaire.

Question 1.6: I use a computer at?

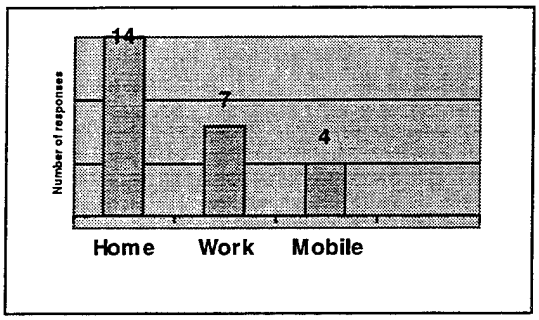

Figure 4.6. Computer use

Question 1.7: I use computer for what?

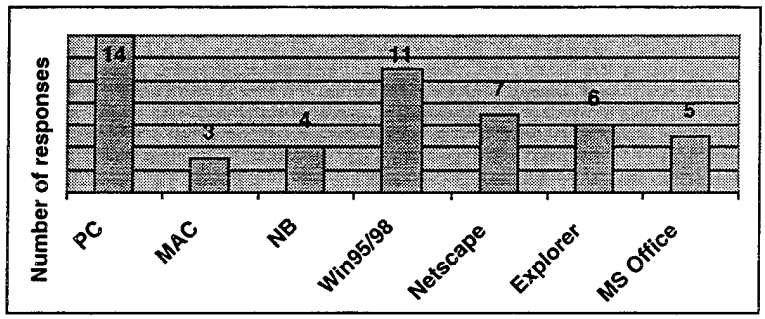

Figure 4.7. Computer Application

Activities perform on computer include: E-mail and Web access or Web browsing being performed by all respondents; word processing being used by seventy-one percent of the participants. Other applications include, forty-two percent using presentation graphics and twenty-one percent using financial programs and twenty-one percent indicating they play games. A small percent indicated that they used the computer to perform spreadsheet or DoD applications.

Question 1.8: What type of activities do you perform on computers?

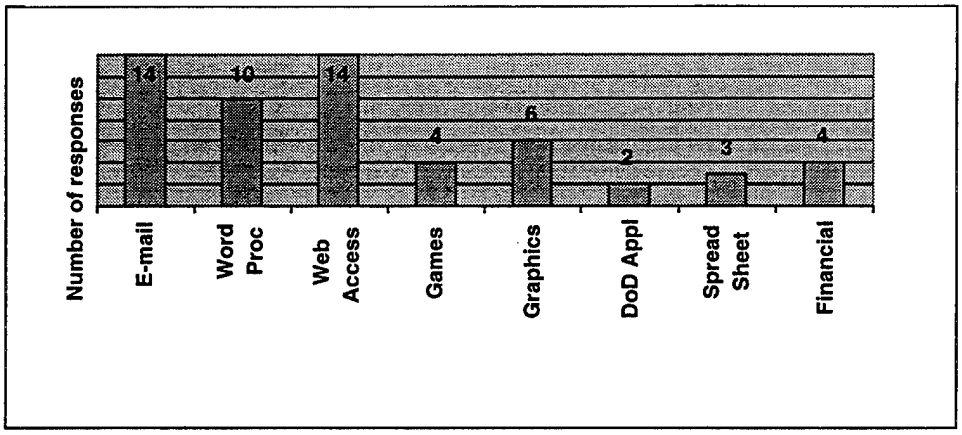

Figure 4.8. Computer Activities

Sixty-four percent of the respondents indicated that they had never completed a formal computer course. Over half of the respondents, fifty-seven percent rated their computer skills as intermediate, while twenty-eight percent indicated themselves as novice.

Question 1.9: Have you ever completed a formal computer course?

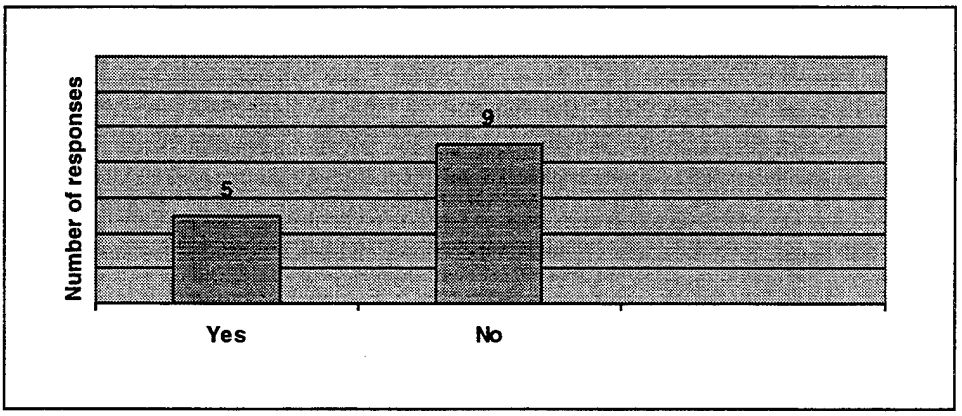

Figure 4.9. Formal course

Question 1.10: How would you rate your computer skills?

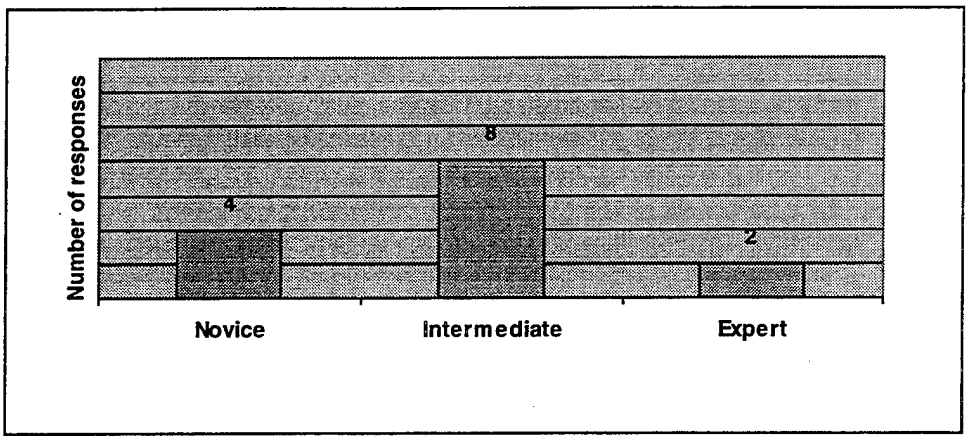

Figure 4.10. Computer skills

Time spend on the Internet was distributed between zero to thirty, thirty to sixty minutes and one to three hours, each of these categories received fifty percent, thirty-five percent and fifteen percent respectively. Sixty-four percent indicated they browse or search the Web several times daily and thirty-six percent classified themselves at once daily. Seventy-one percent spend two to ten minutes on a Web site once they reach it, twenty-one percent spend zero to two minutes, and eight percent spend ten to thirty minutes at a site once they get there.

Question 1.11: In total, approximately how much time to you spend on the internet?

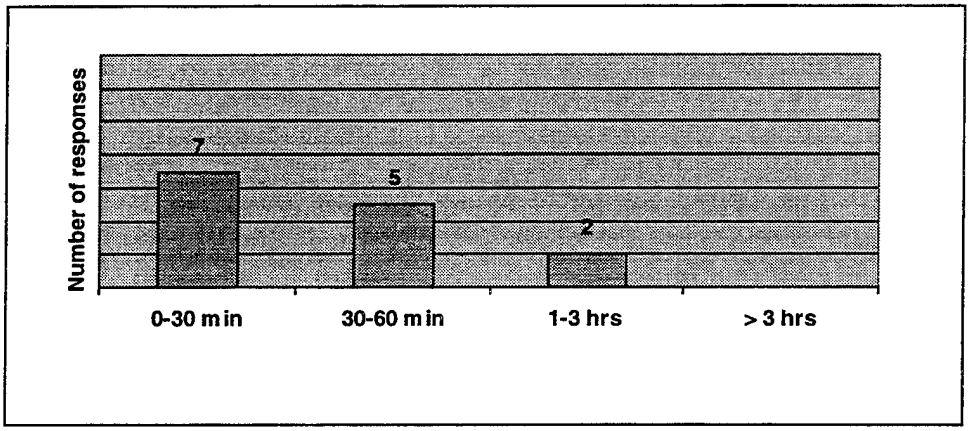

Figure 4.11. Internet usage

Question 1.12: Approximately how often do you Browse or Search the Web?

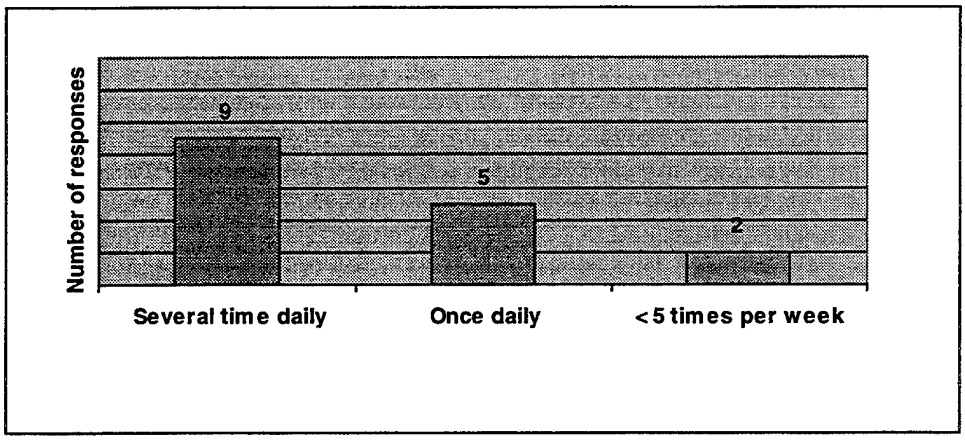

Figure 4.12. Web access time

Question 1.13: When you get on a Web site, how long do you stay there?

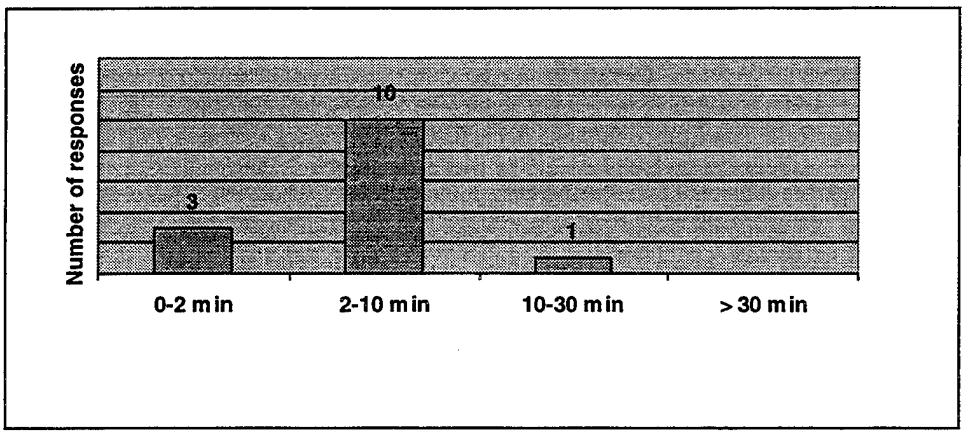

Figure 4.13. Web site visit time

Table 4.1 shows the ranking for actions taken once the respondents are finished looking at a Web site. Seven out of fourteen respondents indicated that then jump to another Web site without using a link as the most preferred action. The second most preferred action indicated by the respondents is to follow a link to another Web site.

Question 1.14. When you are finished looking at a web site, do you (rank in order, with 1 being most used action):

	Responses															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	**Mean Rank**	**Overall Rank**
Follow a query-retrieved suggestion	2	3	4	4	2	3	2	4	3	3	4	2	4	3	**3.00**	**4**
Jump to another Web site without using a link	3	1	3	1	1	4	3	2	1	1	3	3	1	1	**1.50**	**1**
Follow a link to another Web site	4	2	1	3	3	2	1	3	2	2	2	4	2	2	**2.00**	**2**
Close the browser	1	4	2	2	4	1	4	1	4	4	1	1	3	4	**2.50**	**3**

Table 4.1 Most Popular Action Taken When Finished Viewing a Web Site

Each user was asked to rank order common web page problems that detract from the page's usability the most. Table 4.2 shows the overall results to this question.

Question 1.15. Regarding the graphic user interface used on Web sites you visit, what do you find most detracting? (rank in order, with 1 being most used action):

	Responses															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	**Mean Rank**	**Overall Rank**
Long download times	1	2	1	1	3	1	2	1	2	1	2	3	1	2	**1.64**	**1**
Long scrolling pages	2	3	2	6	1	3	3	2	3	3	1	1	2	3	**2.50**	**2**
Scrolling text, marquees ads, constantly running animation	3	1	5	6	6	5	7	7	1	4	6	2	5	4	**4.43**	**5**
Counter intuitive links	4	4	3	4	2	2	6	4	4	2	3	5	4	1	**3.43**	**3**
Lack of navigation support	5	6	4	3	4	4	1	3	5	7	4	6	3	5	**4.29**	**4**
Non-standard link colors	6	7	6	7	5	6	5	5	6	6	5	7	6	6	**5.93**	**7**
Poor color schemes	7	5	7	2	7	7	4	6	7	5	7	4	7	7	**5.86**	**6**

Table 4.2 Regarding GUI used on Web Site – Most Detracting

This data confirms Nielsen's points about Web site design. It also verifies that aviation personnel want many of the same features as the users in Nielsen's usability test.

Complexity of a Web site's address was not viewed as a discouraging factor in whether or not participants visited or used that (Figure 4.14 and Table 4.3).

Question 1.16: The complexity of a Web site's address discourages me from visiting/using that site.?

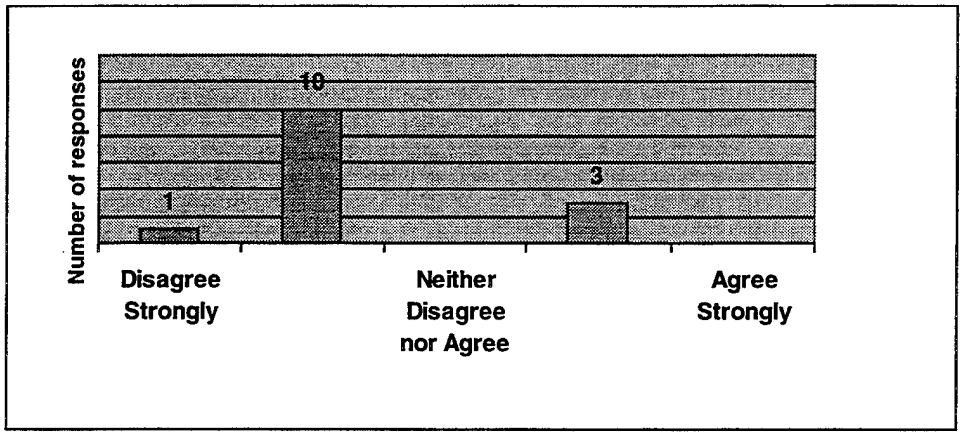

Figure 4.14. Web site address complexity

Table 4.3 Response Statistics for Question 1.16

Statistic	Value
Mean	2.36
Median	2.00
Std Deviation	0.928

The next three questions explored how participants view computers with respect to the workplace. Twelve of the fourteen respondents indicated that computers do not make them more productive (Figure 4.15 and Table 4.4). Half of the participants indicated that computer increase their workload (Figure 4.16 and Table 4.5). Eight of the fourteen participants disagree strongly that computer reduce paperwork (Figure 4.17 and Table 4.6).

Question 1.17: Computers make me more productive?

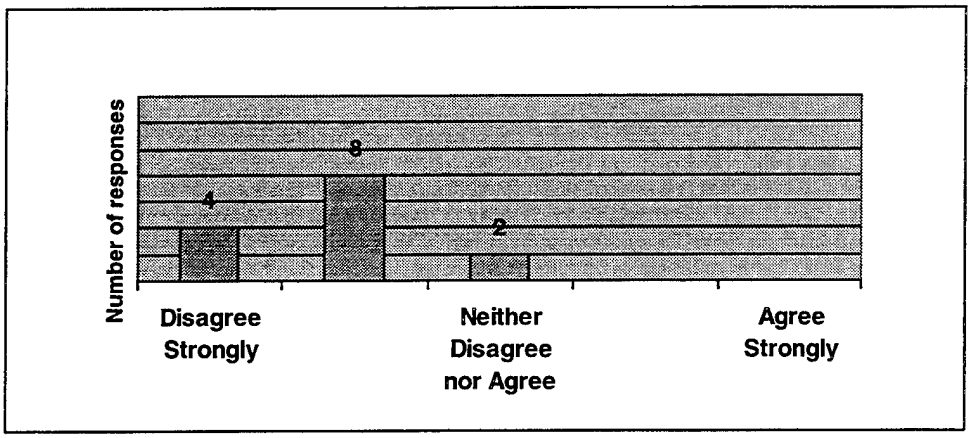

Figure 4.15. Productivity

Table 4.4 Response Statistics for Question 1.17

Statistic	Value
Mean	1.86
Median	2.00
Std Deviation	0.662

Question 1.18: Computer increase my workload?

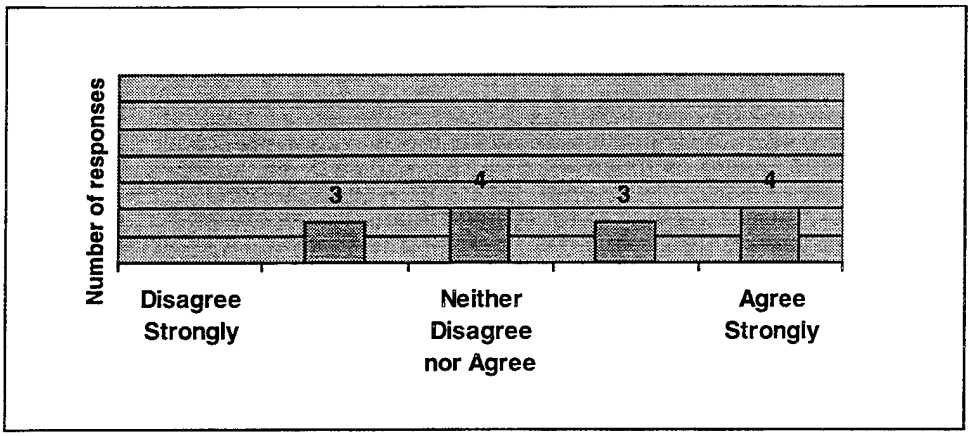

Figure 4.16. Workload

Table 4.5 Response Statistics for Question 1.18

Statistic	Value
Mean	3.57
Median	3.50
Std Deviation	1.15

Question 1.19: Computers reduce paperwork?

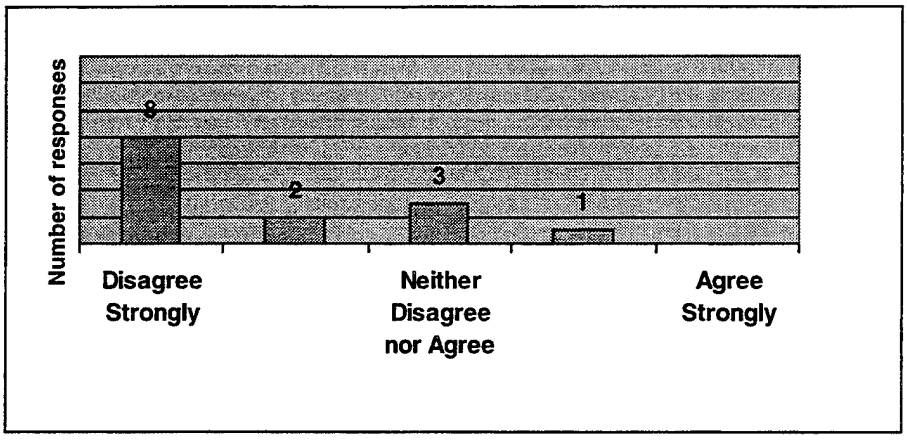

Figure 4.17. Computers Reduce Paperwork

Table 4.6 Response Statistics for Question 1.19

Statistic	Value
Mean	1.79
Median	1.00
Std Deviation	1.05

General questions were asked in which the participants could write in responses (Appendix E). The first of these was to list three Web sites they like and give the reasons why. Eleven of the fourteen responses involved news related sites like ABC, CNBC, CNN, the Weather Channel, the Washington Post and ZDNet, while six participants specifically listed ESPN. The reoccurring comment for ESPN site was that it contained good links to many other sites of interest. There were two references to search engines, due to the weath of informaiton possible there. Other sites that were not preferred were shunned because of broken links, promise but no substance, gratuitious graphics, most news sites for not being interactive, and search engines for being low yield. Other sites were singled out for requiring too much time to find the desired information (i.e. non-

intuitive sites), non-current information, too much advertising, and sites that were not connected or hyperlinked.

2. ACSA Specific Survey

In the first section of this survey, participants were asked to respond to a set of statements specifically regarding the ACSA Web site. The first series of questions was to get an overall impression about the ACSA Web site. The following pages present a detailed statistical breakdown of responses to each question of the questionnaire. The first seven questions focused on information content of the ACSA Web site. These seven questions were used to explore participants' perception of whether the ACSA Web site would the needs of the user. Most participants indicated that the ACSA Web site provided information that was relevant, accurate, complete, current, required, intuitive and easy to read. Figure 4.18 through Figure 4.24 and Table 4.8 through Table 4.14 show the statistical breakdown.

Question 2.1: Information on the site is relevant?

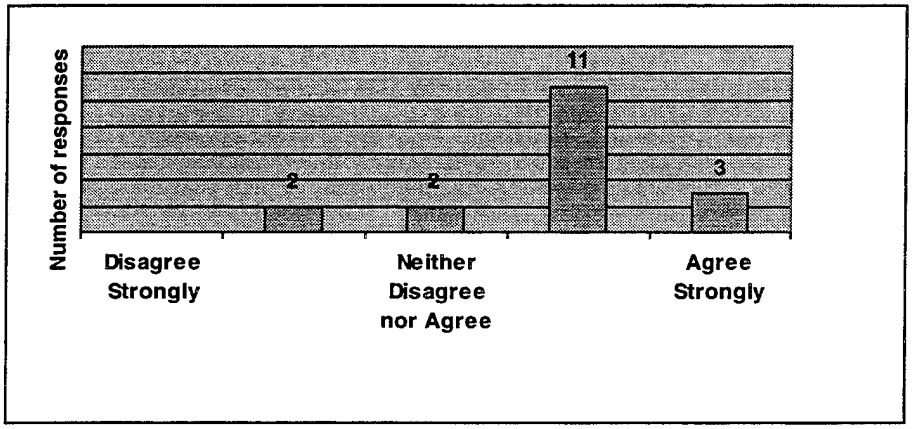

Figure 4.18. Relevant Information

Table 4.7 Response Statistics for Question 2.1

Statistic	Value
Mean	3.83
Median	4.00
Std Deviation	0.857

Question 2.2: Information on the site is accurate?

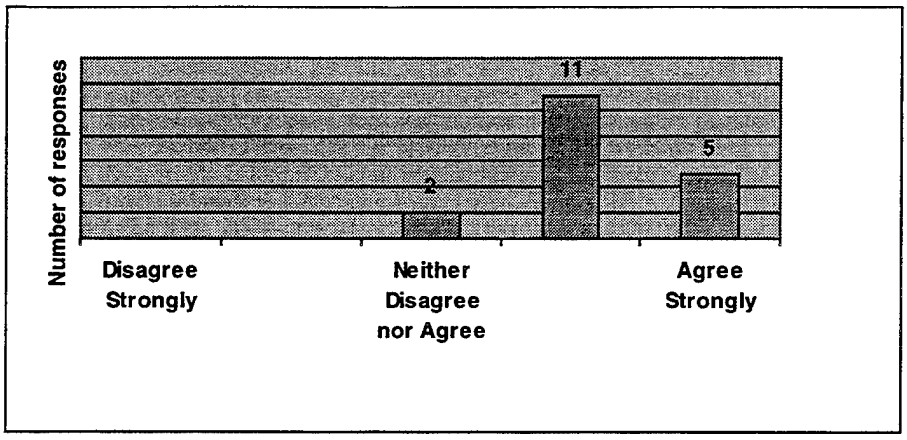

Figure 4.19. Accurate Information

Table 4.8 Response Statistics for Question 2.2

Statistic	Value
Mean	4.17
Median	4.00
Std Deviation	0.618

Question 2.3: Information on the site is complete?

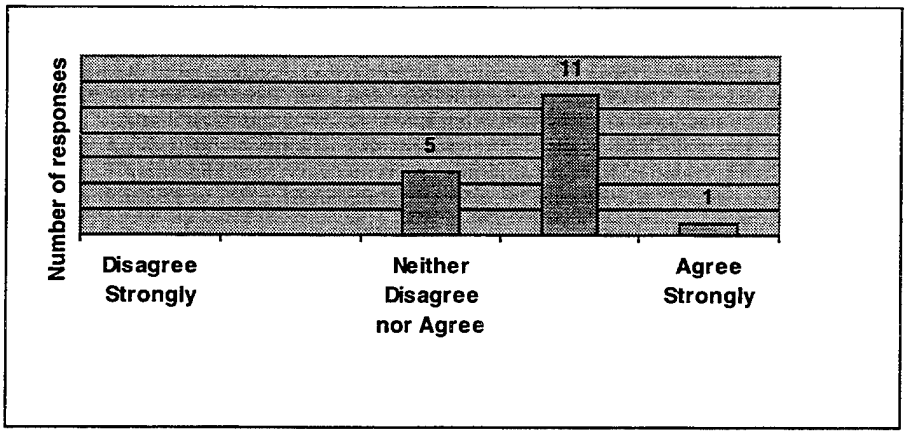

Figure 4.20. Complete Information

Table 4.9 Response Statistics for Question 2.3

Statistic	Value
Mean	3.61
Median	4.00
Std Deviation	0.849

Question 2.4: Information on the site is current?

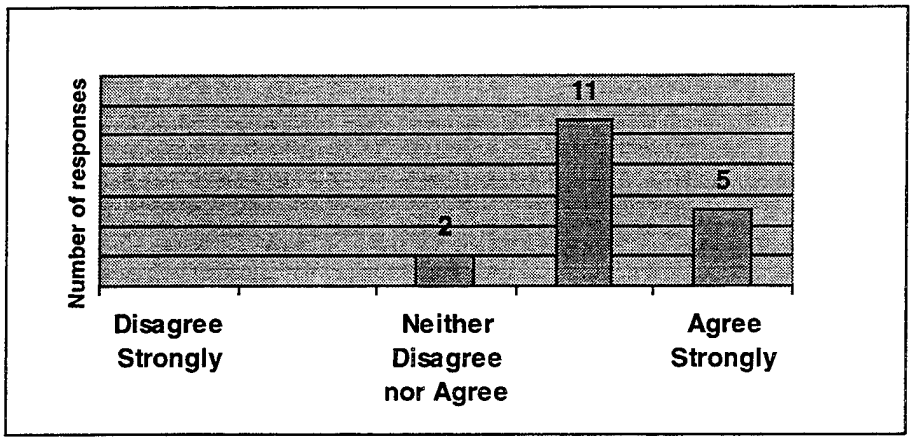

Figure 4.21. Current Information

Table 4.10 Response Statistics for Question 2.4

Statistic	Value
Mean	3.94
Median	4.00
Std Deviation	0.639

Question 2.5: Information on the site meets my needs?

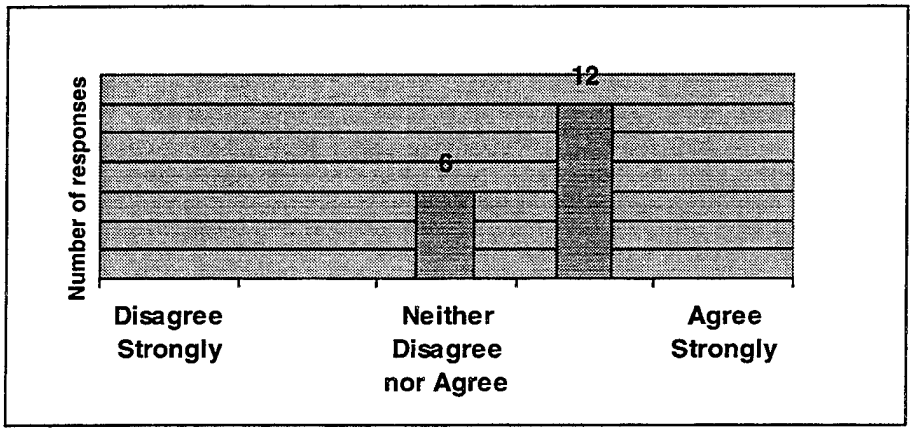

Figure 4.22. Information Meets Needs

Table 4.11. Response Statistics for Question 2.5

Statistic	Value
Mean	3.67
Median	4.00
Std Deviation	0.485

Question 2.6: Information on the site is intuitive?

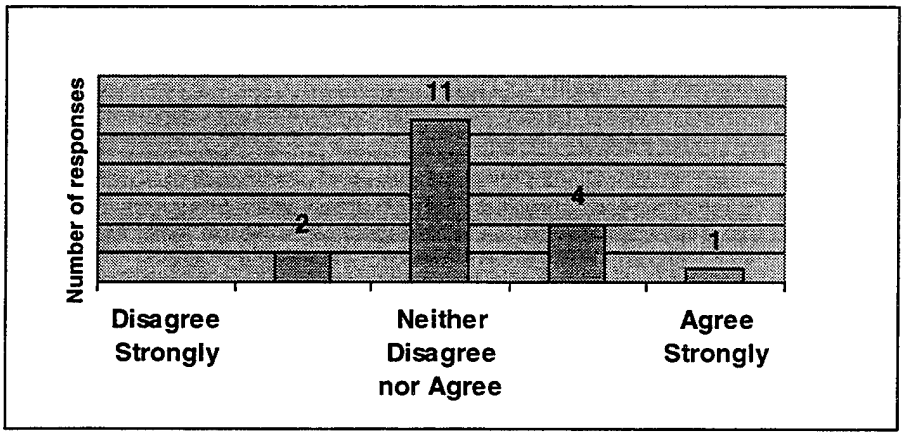

Figure 4.23. Information Intuitive

Table 4.12. Response Statistics for Question 2.6

Statistic	Value
Mean	3.22
Median	3.00
Std Deviation	0.732

Question 2.7: Information on the site is easy to read?

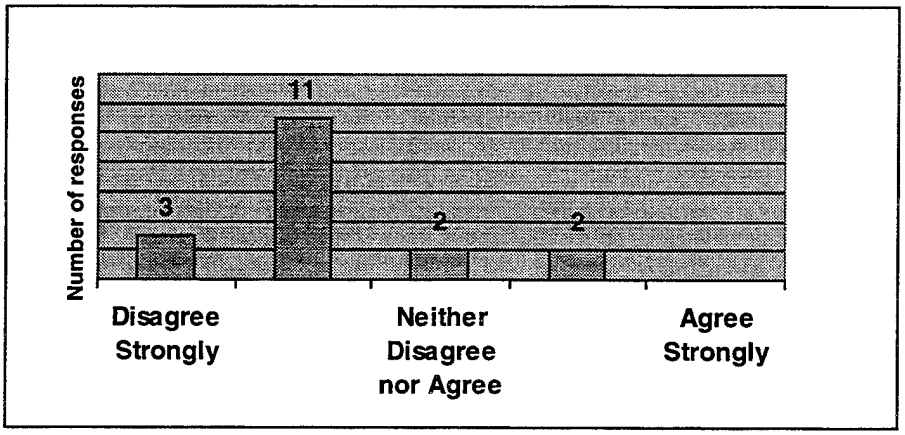

Figure 4.24. Information Easy to Read

Table 4.13 Response Statistics for Question 2.7

Statistic	Value
Mean	2.17
Median	2.00
Std Deviation	0.857

Questions concerning general appearance of the ACSA Web site indicated general satisfaction. Site address was not considered too complex (Figure 2.25 and Table 4.15). Most agreed that scrolling was not too excessive (Figure 2.26 and Table 4.16). Link colors and colors used throughout the Web site were acceptable (Figure 2.27 and Figure 2.28, Table 4.17 and Table 4.18). The amount of graphics used received mixed opinions but generally the Web site appears to have a good blend (Figure 2.29 and Table 2.19), however the user indicated that they generally did not want additional graphics added (Figure 2.30 and Table 2.20).

Question 2.8: The site address is too complex?

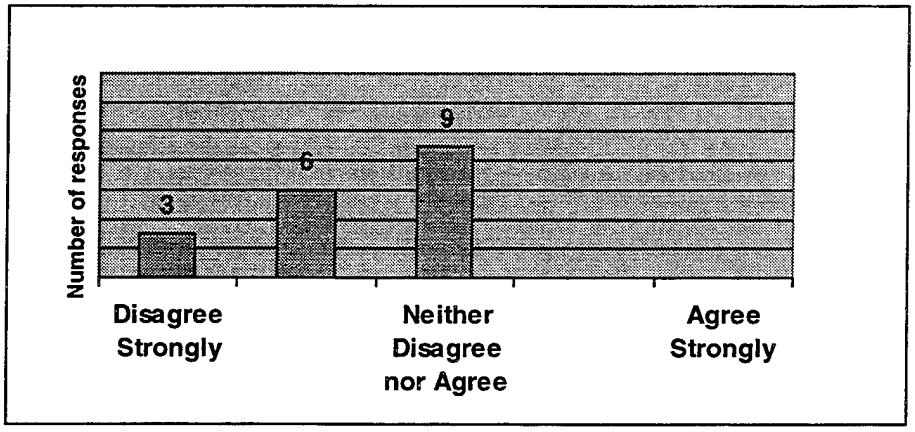

Figure 4.25. Address Complexity

Table 4.14 Response Statistics for Question 2.8

Statistic	Value
Mean	2.33
Median	2.50
Std Deviation	0.766

Question 2.9: The amount of page scrolling is acceptable?

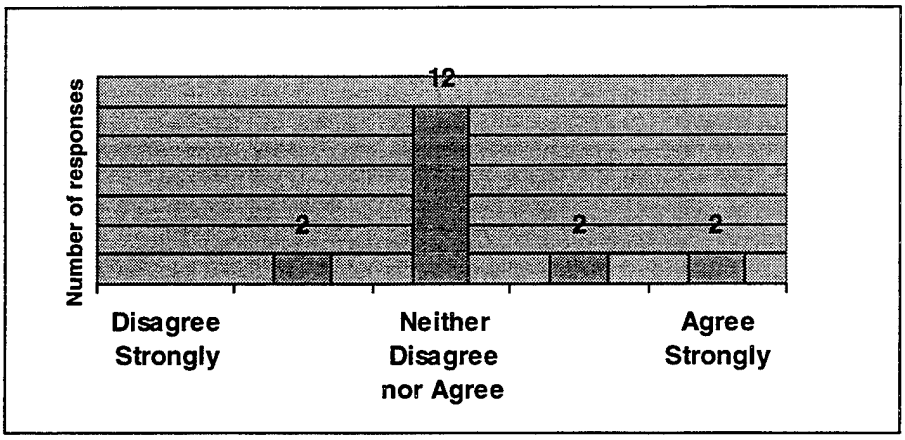

Figure 4.26. Page Scrolling

Table 4.15 Response Statistics for Question 2.9

Statistic	Value
Mean	3.22
Median	3.00
Std Deviation	0.808

Question 2.10: The link colors are acceptable?

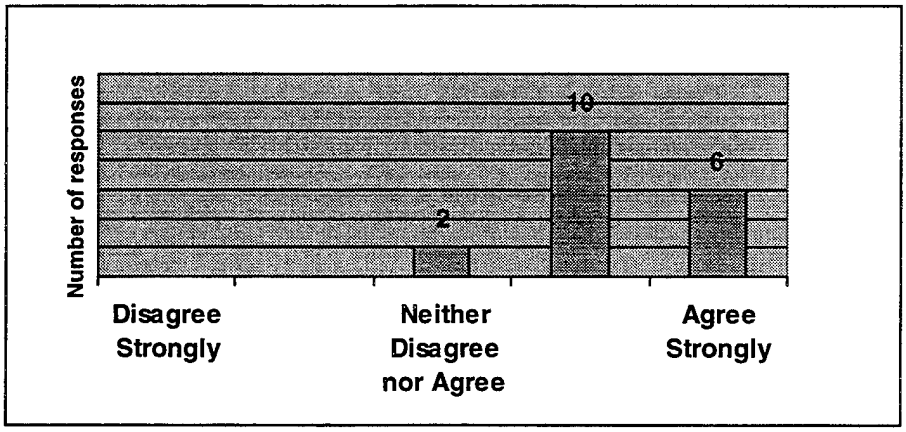

Figure 4.27. Link Colors

Table 4.16 Response Statistics for Question 2.10

Statistic	Value
Mean	4.22
Median	4.00
Std Deviation	0.646

Question 2.11: The colors used throughout the site are acceptable?

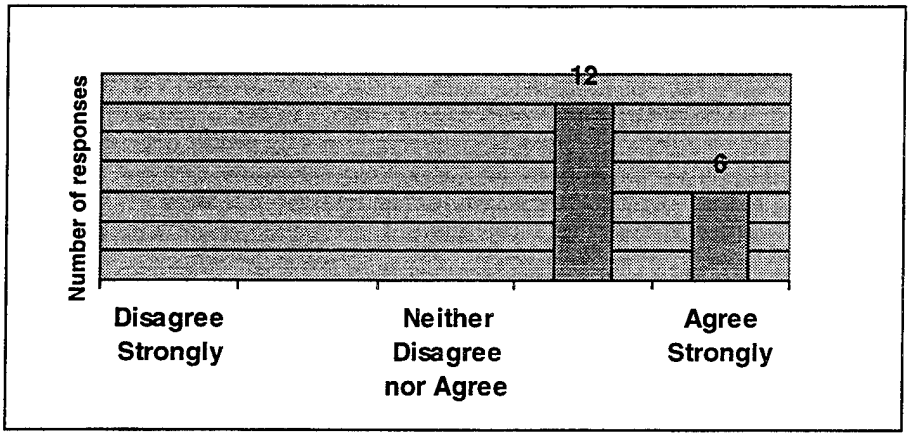

Figure 4.28. Site Colors

Table 4.17 Response Statistics for Question 2.11

Statistic	Value
Mean	4.33
Median	4.00
Std Deviation	0.485

Question 2.12: The amount of graphics is acceptable?

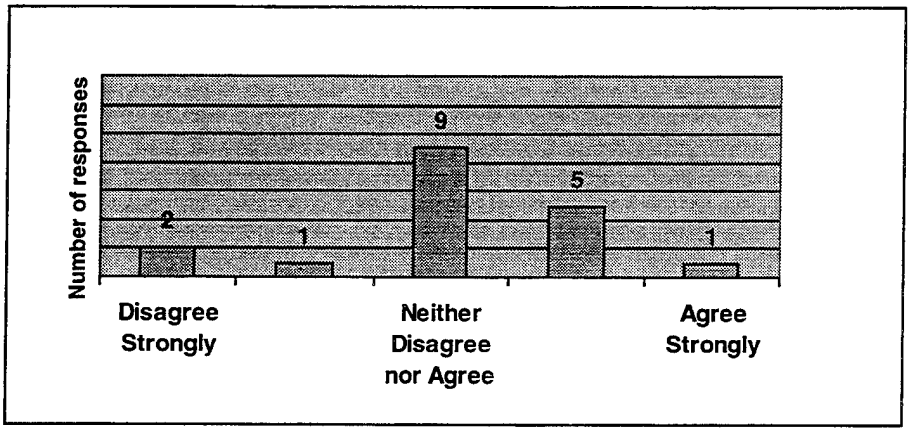

Figure 4.29. Graphics

Table 4.18 Response Statistics for Question 2.12

Statistic	Value
Mean	3.11
Median	3.00
Std Deviation	1.022

Question 2.13: I would like to see more graphics.

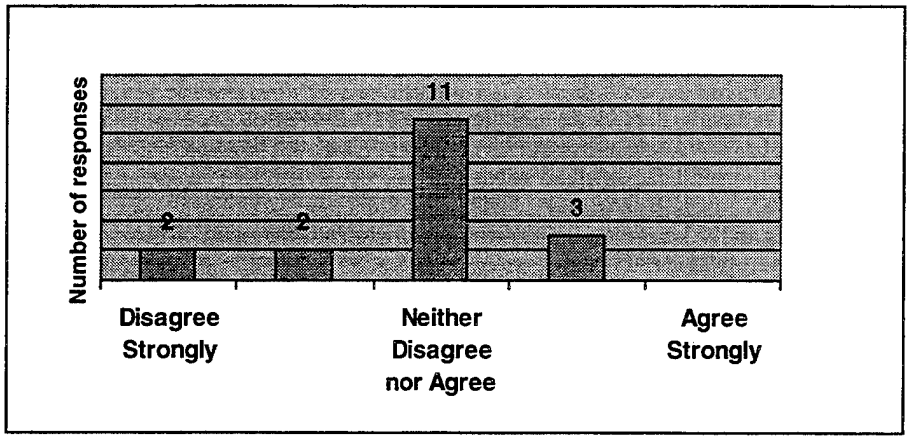

Figure 4.30. More Graphics

Table 4.19 Response Statistics for Question 2.13

Statistic	Value
Mean	2.78
Median	3.00
Std Deviation	0.878

The next two question concerned down load times between HTML and Java applets. Download times for the HTML format are generally acceptable (Figure 4.31 and Table 4.20), however, Java applet download times were viewed as unacceptable (Figure 4.32 and Table 4.21).

Question 2.14: Download times are acceptable (HTML format).

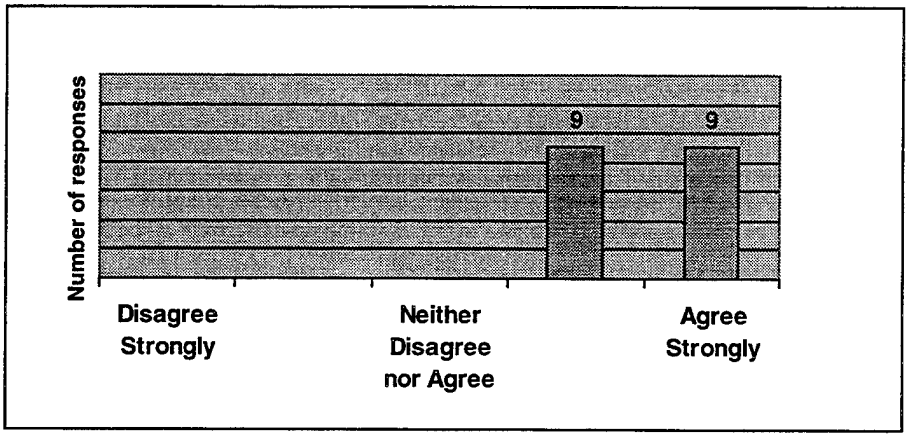

Figure 4.31. HTML Download Times

Table 4.20 Response Statistics for Question 2.14

Statistic	Value
Mean	4.50
Median	4.50
Std Deviation	0.514

Question 2.15: Download times are acceptable (Survey Applet).

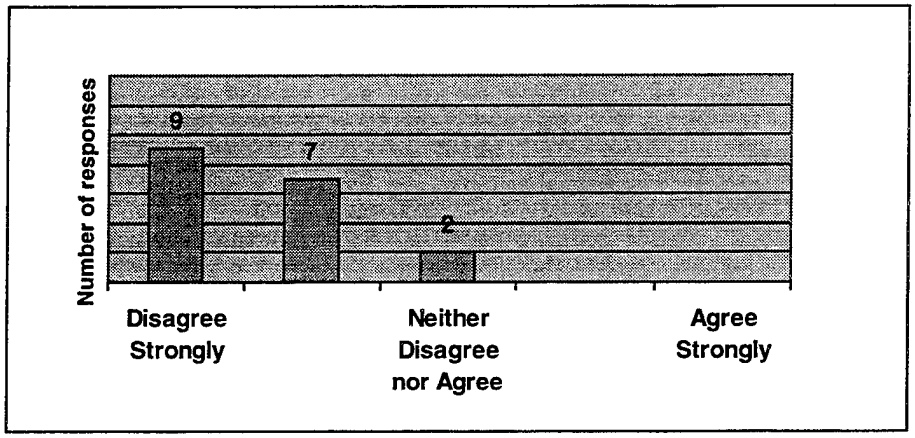

Figure 4.32. Survey Applet Download Times

Table 4.21 Response Statistics for Question 2.15

Statistic	Value
Mean	1.61
Median	1.50
Std Deviation	0.697

Question concerning navigation through the ACSA Web site received less favorable response. Navigation support was considered to be lacking in that there were no links to questions or common problems (Figure 4.33 and Table 4.22). Navigation from one web page to another was considered clear (Figure 4.34 and Table 4.23).

Question 2.16: Navigation support is acceptable.

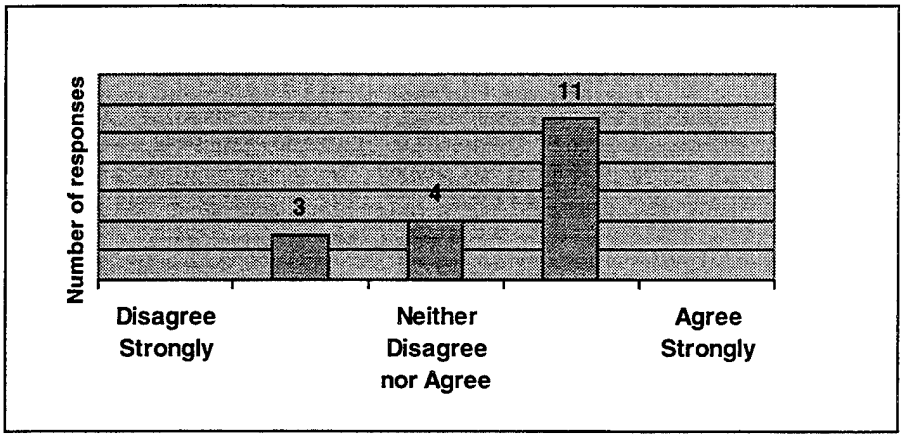

Figure 4.33. Navigation Support

Table 4.22 Response Statistics for Question 2.16

Statistic	Value
Mean	3.44
Median	4.00
Std Deviation	0.783

Question 2.17: Navigation through the site is intuitive.

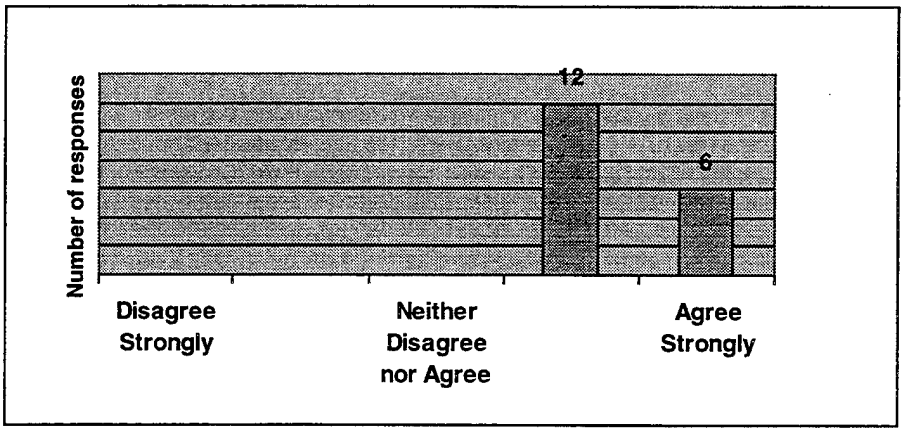

Figure 4.34. Navigation Intuitive

Table 4.23 Response Statistics for Question 2.17

Statistic	Value
Mean	4.33
Median	4.00
Std Deviation	0.485

The next series of questions centered around individual Web page design and overall presentation. These questions focused attention on the seven pages which comprise the ACSA Web site. Web site design and overall presentation of for each page was rated and generally received favorable marks. The Main page design and overall presentation received positive marks (Figure 4.35 and Table 4.24). The HTML Survey page receieved a very good rating with ten of the eighteen respondents rating it at very good (Figure 4.36 and Table 4.25).

Question 2.18: Main page design/overall presentation.

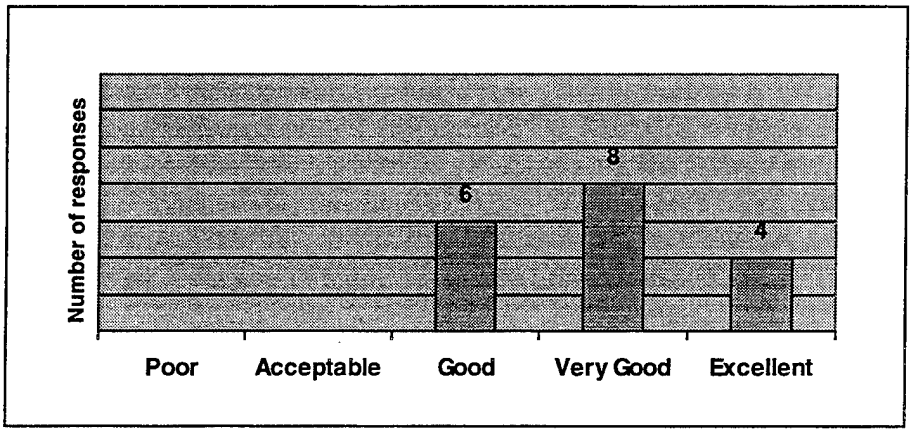

Figure 4.35. Main Page Design

Table 4.24 Response Statistics for Question 2.18

Statistic	Value
Mean	3.89
Median	4.00
Std Deviation	0.758

Question 2.19: HTML survey page design/overall presentation.

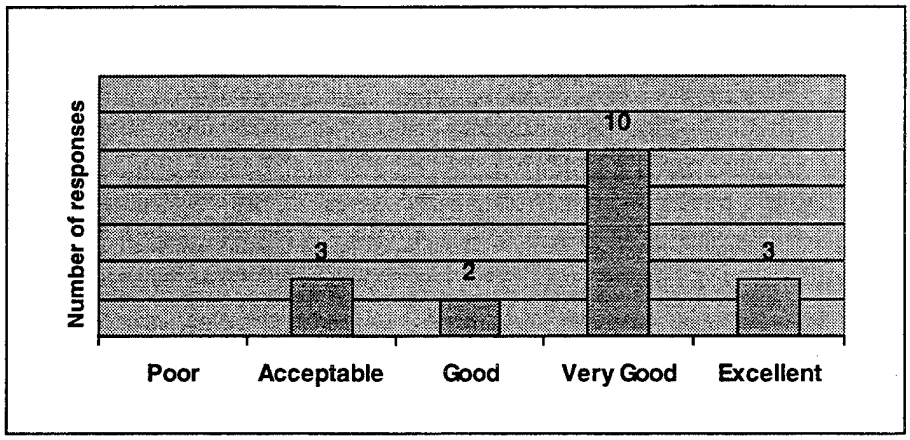

Figure 4.36. HTML Survey Page Design

Table 4.25 Response Statistics for Question 2.19

Statistic	Value
Mean	3.72
Median	4.00
Std Deviation	0.958

The Survey Applet page design received mixed rating with five of the eighteen participants indicating it was a poor design. Primary reason for such a low rating was primary due to flashing text, undulating text, and scrolling pages (Figure 4.37 and Table 4.26). Several participants indicated that downloading the Survey Applet was excess and often timed out due to server none response errors.

Question 2.20: Survey Applet page design/overall presentation.

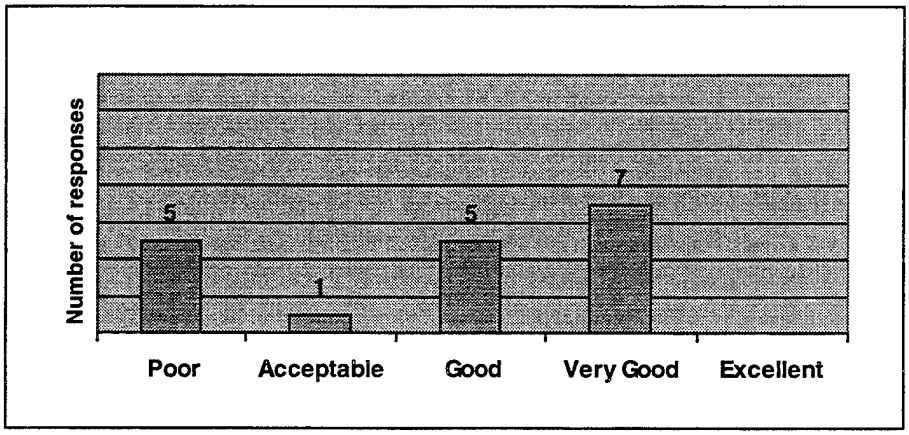

Figure 4.37. Survey Applet Page Design

Table 4.26 Response Statistics for Question 2.20

Statistic	Value
Mean	2.78
Median	3.00
Std Deviation	1.262

Participants's responses to design of the Results Applet page indicated gereral satisfaction, however, eight participants left this question blank due to non-access to the page. Several questions did arise during the interview which question why squadron personnel would have access to the survey data. This page was designed to give Commanding Officer the ability to view results of a question and make comparisons with other units. Due to the limited availablity of Commanding Officers to participant in the ACSA usability survey it was included soley in a effort to evaluate it as a useful tool in the future. Ten of the eighteen responses are presented in Figure 4.38 and Table 4.27.

Question 2.21: Results Applet page design/overall presentation.

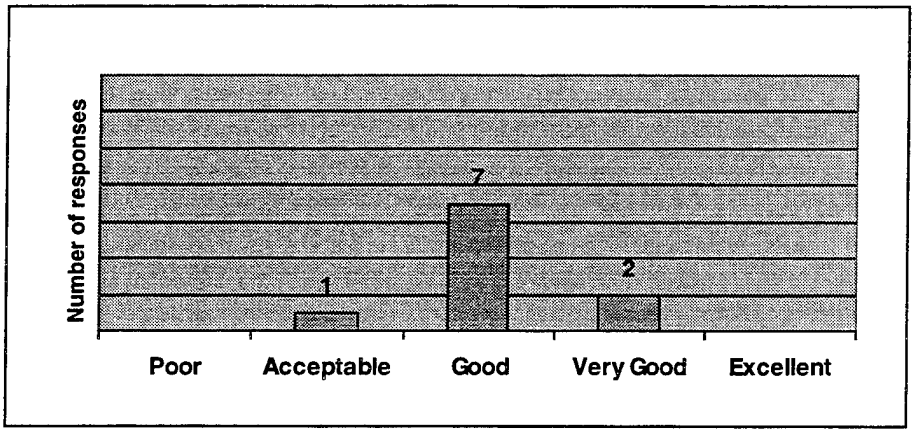

Figure 4.38. Results Applet Page Design

Table 4.27 Response Statistics for Question 2.21

Statistic	Value
Mean	3.10
Median	3.00
Std Deviation	0.567

Participants' responses to questions concerning the design/overall presentation of the Help page was acceptable (Figure 4.39 and Table 4.28). Design and overall presentation with respect to Secure HTML Survey page received mixed results due to a lack of understanding between the HTML Survey page and Secure HTML Survey page (Figure 4.40 and Table 4.29). Participants' response to design and overall presentation of the ACSA newsgroup page indicated a lack of understanding of what the page was design for (Figure 4.41 and Table 4.30). Several responses to these two questions were left blank and only eleven participants indicated a response.

Question 2.22: Help page design/overall presentation.

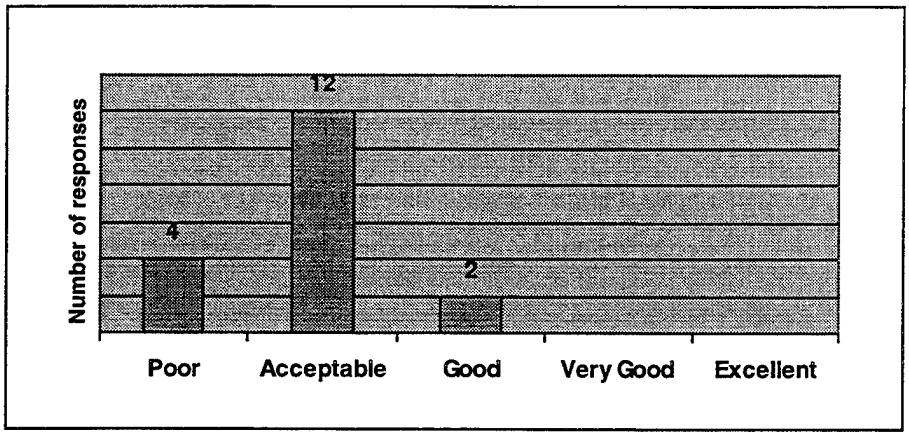

Figure 4.39. Help Page Design

Table 4.28 Response Statistics for Question 2.22

Statistic	Value
Mean	1.89
Median	2.00
Std Deviation	0.583

Question 2.23: Secure HTML Survey design/overall presentation.

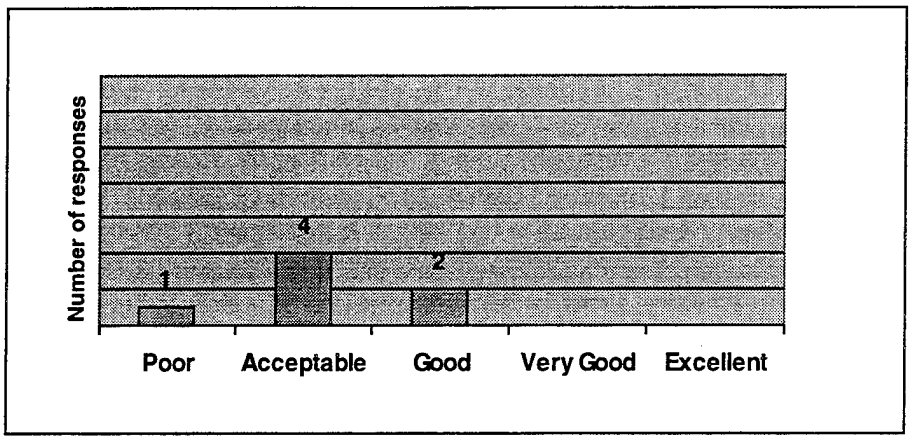

Figure 4.40. Secure HTML Survey Page Design

Table 4.29 Response Statistics for Question 2.23

Statistic	Value
Mean	2.17
Median	2.00
Std Deviation	0.752

Question 2.24: ACSA newsgroup design/overall presentation.

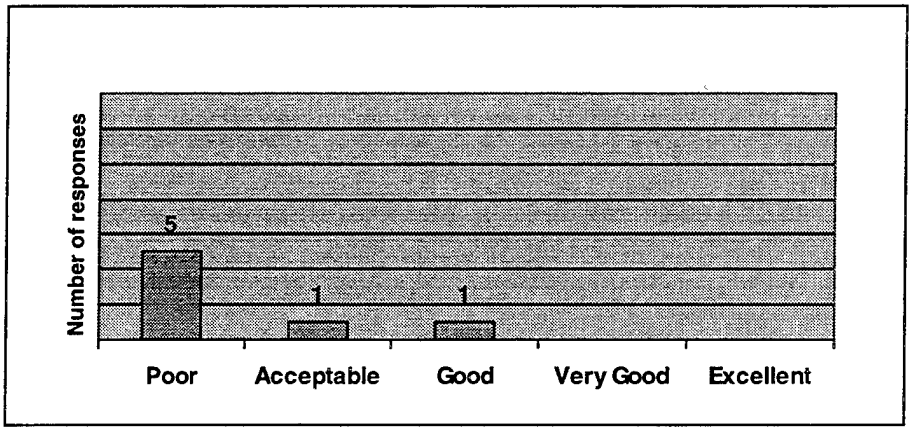

Figure 4.41. ACSA Newsgroup Page Design

Table 4.30 Response Statistics for Question 2.24

Statistic	Value
Mean	1.43
Median	1.00
Std Deviation	0.786

The next series of questions were to have each participant rate each page according to functionality and ease of use. Instructions of Main page received only minor favorable results due too the technical tone of instructions and lack of any statements concern confidentiality (Figure 4.42 and Table 4.31).

Question 2.25: Functionality & Ease of use for Instructions on Main page.

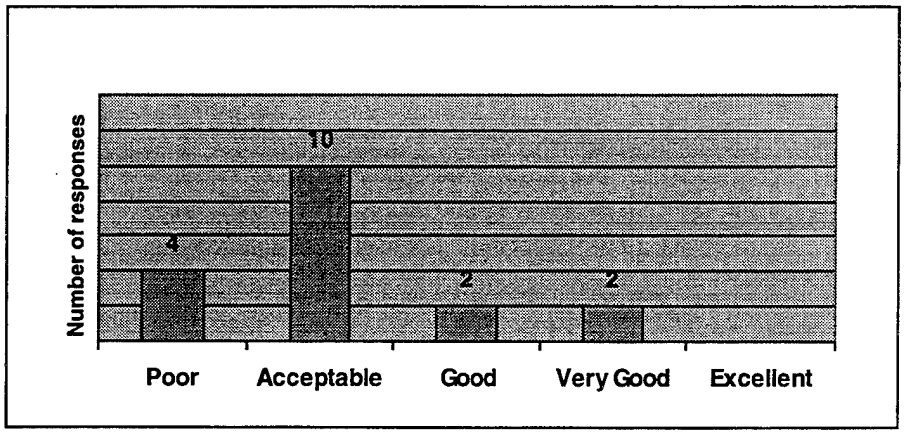

Figure 4.42. Main Page Functionality

Table 4.31 Response Statistics for Question 2.25

Statistic	Value
Mean	2.11
Median	2.00
Std Deviation	0.900

The next two questions compared two different survey formats, HTML and Java Applet. Participants indicated a preference for the HTML survey for several reasons, such as, easy of reading, download time, color separation for each question and not having too scroll to read each question (Figure 4.43 and Table 4.32).

Question 2.26: Functionality & Ease of use for HTML Survey page.

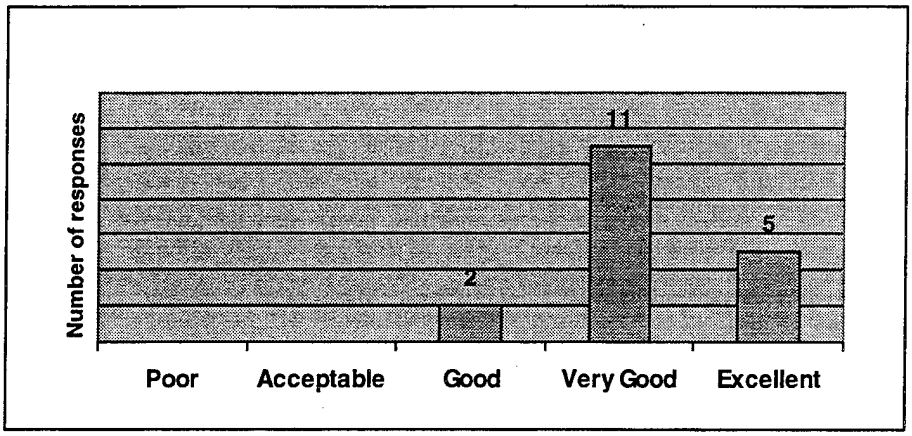

Figure 4.43. HTML Survey Functionality

Table 4.32 Response Statistics for Question 2.26

Statistic	Value
Mean	4.17
Median	4.00
Std Deviation	0.618

A majority of the participants indicated that the Survey Applet format was acceptable but not as good as the HTML format. Responses during the interview indicated that due to fashing text, alignment while reading and selecting the answer, layout of page and scrolling to read each question contributed to negative views (Figure 4.44 and Table 4.33).

Question 2.27: Functionality & Ease of use for Survey Applet page.

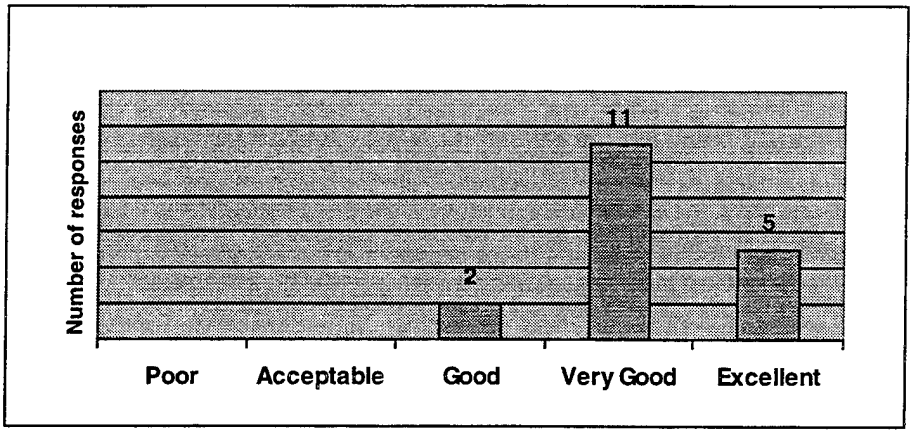

Figure 4.44. Survey Applet Functionality

Table 4.33 Response Statistics for Question 2.27

Statistic	Value
Mean	2.33
Median	2.00
Std Deviation	0.485

Participants's responses to functionality and ease of use of the Results Applet page indicated gereral satisfaction, however, eight participants left this question blank due to non-access to the page. Many participants indicated during the interview that the Results Applet was an impressive tool for Commanding Offiers to use. Several participants made postive comments on the ability to view data in many different queries. Ten of the eighteen responses are presented in Figure 4.45 and Table 4.34.

Question 2.28: Functionality & Ease of use for Results Applet page.

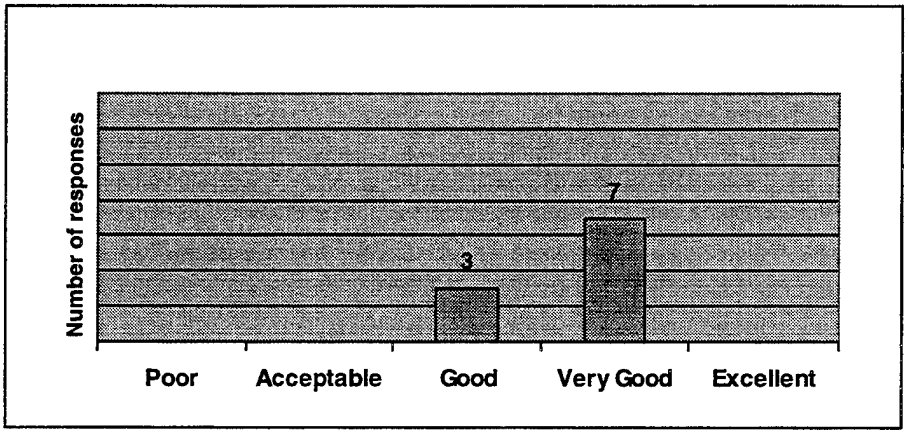

Figure 4.45. Results Applet Functionality

Table 4.34 Response Statistics for Question 2.28

Statistic	Valne
Mean	3.70
Median	4.00
Std Deviation	0.483

The Help page was not hard to understand and received favorable marks, however, participants indicated a need for a table of contents and links to major points in the help page. Several participants challenged the naming of Help page while providing nothing more than a frequently asked questions page (Figure 4.46 and Table 4.35).

Question 2.29 Functionality & Ease of use for Help page.

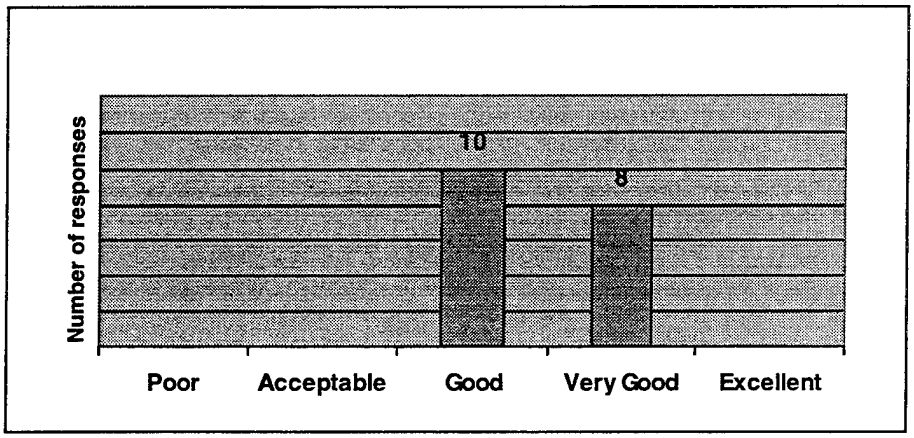

Figure 4.46. Help Functionality

Table 4.35 Response Statistics for Question 2.29

Statistic	Value
Mean	3.44
Median	3.00
Std Deviation	0.511

Functionality and ease of use with respect to Secure HTML Survey page once again received mixed results due to a lack of understanding between the HTML Survey page and Secure HTML Survey page (Figure 4.47 and Table 4.36). Participants' response to functionality and ease of use to the ACSA newsgroup page indicated a lack of understanding of what the page was design for (Figure 4.48 and Table 4.37). Several responses to these two questions were left blank and only eleven participants indicated a response.

Question 2.30: Functionality & Ease of use for Secure HTML page.

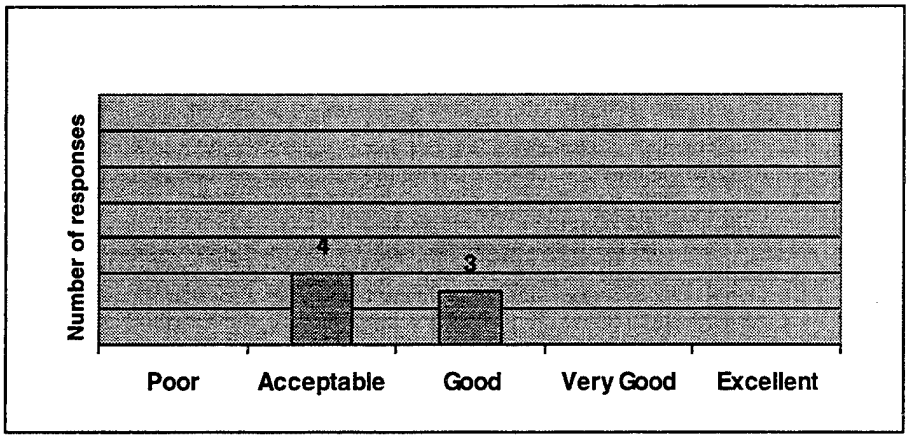

Figure 4.47. Secure HTML Functionality

Table 4.36 Response Statistics for Question 2.30

Statistic	Value
Mean	2.17
Median	2.00
Std Deviation	0.752

Question 2.31: Functionality & Ease of ACSA newsgroup page.

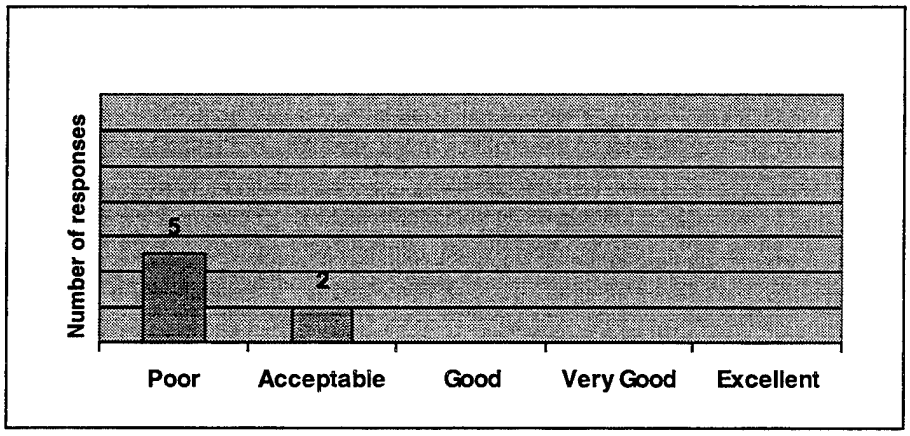

Figure 4.48. ACSA Newsgroup Functionality

Table 4.37 Response Statistics for Question 2.31

Statistic	Value
Mean	1.33
Median	1.00
Std Deviation	0.516

Two questions were used for comparison between the HTML survey and Survey Applet. The HTML format was perferred over the Survey Applet (Figure 4.49 and Table 4.38). The Survey Applet was less desired by most the participants due to flashing text, alignment while reading and selecting the answer, layout of page and scrolling to read each question contributed to negative views (Figure 4.50 and Table 4.39).

Question 2.32: HTML is easier to use.

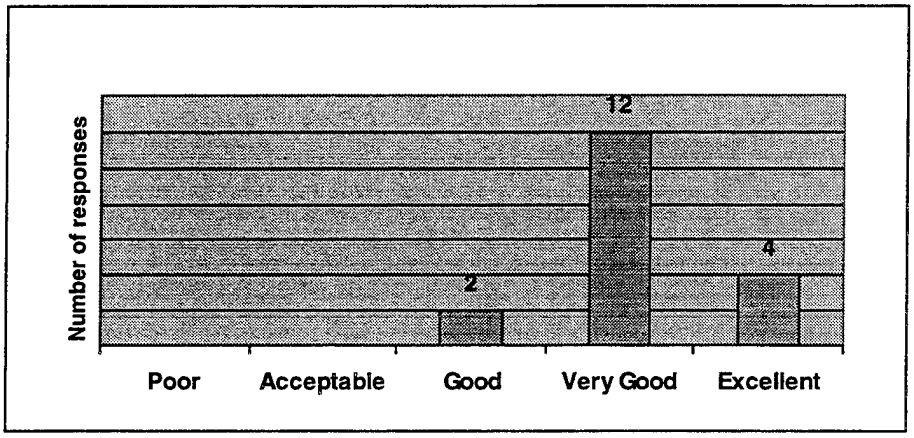

Figure 4.49. HTML Comparison

Table 4.38 Response Statistics for Question 2.32

Statistic	Value
Mean	4.11
Median	4.00
Std Deviation	0.582

Question 2.33: Applet easier to use.

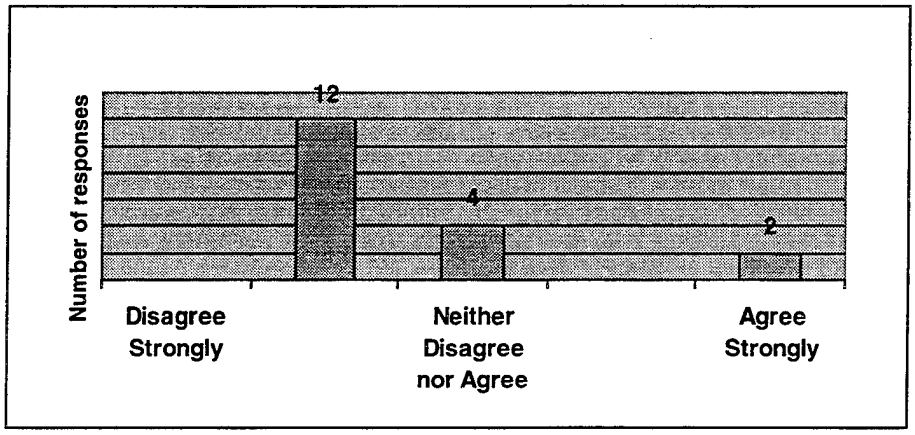

Figure 4.50. Applet Comparison

Table 4.39 Response Statistics for Question 2.33

Statistic	Value
Mean	2.56
Median	2.00
Std Deviation	0.983

The last question asked participants to rate how satisfied they were with the ACSA Web site (Figure 4.51 and Table 4.40). Fifteen of the eighteen responses were either satisfied or very satisfied. From interview comments the Web site was viewed to be innovative and move in the right direction for collectiong survey data. Several Safety Officers commented that the Web site would be welcomed in their squadrons and looked forward to having it as tool to produce mini-surveys in the future.

Question 2.34: Overall, how satisfied are you with the ACSA Web site?

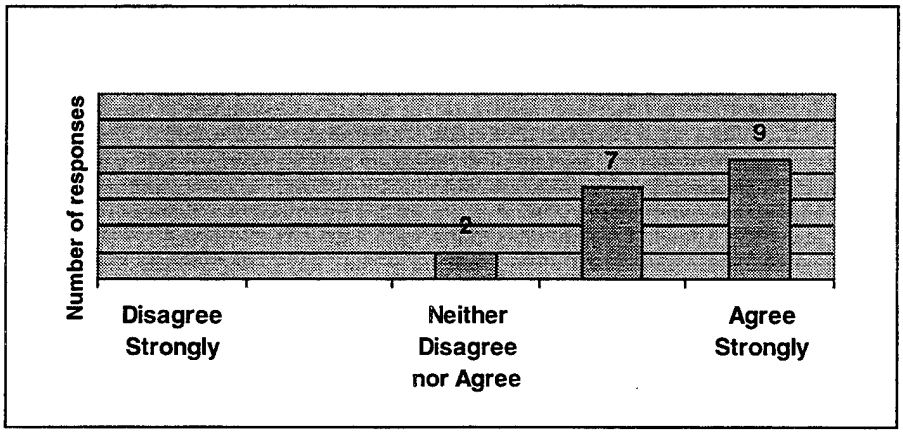

Figure 4.51. Satisfaction of ACSA Web Site

Table 4.40 Response Statistics for Question 2.34

Statistic	Value
Mean	4.39
Median	4.50
Std Deviation	0.697

V. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSION

Knowledge of usability of Web based information tools by aviation personnel holds value for designers of Web pages and sites, as well as the user of those applications. By knowing what to expect and demand, users can shape the future of these designs, and by knowing what users want and desire in a Web site based application, designers can provide systems that are usable and effective. Several conclusions can be drawn from survey results and interviews.

- Simplicity is essential. Users preferred the simple HTML format to the complex Applet format.
- Content is important. If content is lacking the user will look elsewhere.
- Security. Confidentially and anonymity must be intuitive.
- Functionality. Each navigation button must be understandable.
- Download time. Must understand end-user system requirements.
- Page layout. Excessive scrolling of pages must be avoided.
- Usability is the key to success. Proper usability evaluation will save on development and redesign cost.

B. RECOMMENDATIONS

The information obtained from the literature and the insight gained from the surveys and observations lead to several suggestions. These concluding statements should provide the stimulus for change supported by the collated data. The results of this study and the conclusions drawn from the suggest that the actions listed below will

enhance the ACSA Web site and make it a much easier application for collecting survey data.

- Eliminate the Survey Applet from the ACSA Web site. This will decrease loading times and requirements for Java plug-in modules.
- Rewrite the introduction page to include a statement concerning survey goals and objectives, confidentiality of responses, and anonymity of individuals.
- Redesign the help page to include a table of contents, links and list of acronyms.
- An introduction page needs to be included before the *HTML survey* and *Survey Applet.* The page should highlight survey objective, safety goals and requirement for data.
- Removes help links from HTML survey and Survey Applet. These links only send you to the Help page which do not address any survey issues.
- Make either *HTML survey* or *Secure HTML survey* available, not both. Confusion exists between the unsecured and secure formats.
- Provide links to other related Aviation Web site.

C. FUTURE RESEARCH

The recommendations offered are an indication that future work can be done on the ACSA Web site. Research into the saving a partially completed survey is probably necessary in the event an individual cannot complete the survey and must return. Another area of research applicable to the ACSA Web site concerns the effectiveness and efficiency of administering the ACSA survey electronic over a traditional paper.

A study relating the effects of linked information should be performed. This study should attempt to determine whether users prefer links to information that may not be entirely accurate, or no link at all. It could also explore the effects of linked information on the referring Web site.

The lack of literature in this area suggests a fertile area to be probed by future researchers. Additional bodies of data, large enough to be statistically significant should be gathered and analyzed. Continued surveying with the current surveys, or a similar updated survey of this type, would provide further insight into the aviation community as a user of this system.

APPENDIX A. GENERAL WEB SURVEY

Note: Due to formatting differences this survey changed slightly in appearance.

GENERAL WEB SURVEY

Please read the following before continuing.....

Information gained by this survey will be used in a thesis aimed at creating a better Web interface design for the Aviation Command Safety Assessment (ACSA). Accurate information is essential to developing an accurate profile of indented users. Feedback will also be integrated into the ACSA Web site. The information obtained will also allow us to profile the typical users squadron level. The information obtained in this survey is and will remain anonymous; no names will be taken or associated in any way to the information gained.

This survey should take approximately 10 to 15 minutes to complete.

Thank you for taking the time to participate.

General Web Survey

Please take a few minutes to complete this survey. Your specific answers will be completely anonymous, but your views, in combination with those of others, are extremely important.

1. **How many hours per day, on average do you spend at work?**

   8-10 hrs.....☐ 10-12 hrs.....☐ more than 12 hrs.....☐

2. **What is your age?**

   Under 25.....☐ 25 to 27.....☐ 28 to 30.....☐ 31 to 33.....☐ 33 or older.....☐

3. **What is your sex?**

   Male.....☐ Female.....☐

4. **What is your branch of service?**

   Army.....☐ Coast Guard.....☐ Marine Corps.....☐ Navy.....☐ Other.....☐

5. **What is your pay grade?**

   O2.....☐ O3.....☐ O4.....☐ O5.....☐ Other.....☐

6. **I use a computer at (please check all that apply):**

   Home.....☐ Work.....☐ Mobile.....☐

7. **I use (please check all that apply):**

   a PC.....☐ a Macintosh.....☐ a Notebook.....☐
   a Palm Top.....☐ Windows 95/98.....☐ Netscape Browser.....☐
   MS Internet Explorer....☐ MS Office 95/97.....☐
   Other (please write in):_____

8. **What type of activities do you perform on computers (please check all that apply, whether at work or at home):**

   E-mail.....☐ Word Processing.....☐ Web Access/Browsing.....☐
   Games.....☐ Presentations Graphics.....☐ DoD Applications (Supply, Travel).....☐
   Spread sheet.....☐ Financial Programs.....☐ Other.....☐

General Web Survey

Please take a few minutes to complete this survey. Your specific answers will be completely anonymous, but your views, in combination with those of others, are extremely important.

9. Have you ever completed a formal computer course?

Yes.....☐ No.....☐

10. How would you rate your computer skills?

Novice.....☐ Intermediate.....☐ Expert.....☐

Internet use:

11. In total, approximately how much time per day, on average, do you spend on the Internet (i.e. Browsing or searching the web) for any purpose?

0-30 minutes.....☐ 30-60 minutes.....☐ 1-3 hours.....☐ More than 3 hours.....☐

12. Approximately how often do you Browse or Search the Web?

Several times daily.....☐ Once daily.....☐ Less than five times per week.....☐
Less than ten times per month.....☐ Never.....☐

13. When you get to a Web site, how long do you stay there?

0-2 minutes.....☐ 2-10 minutes.....☐ 10-30 minutes.....☐ More than 30 minutes.....☐

14. When you are finished looking at a Web site, do you (rank in order, with 1 being most used action):

Follow a query-retrieved suggestion (i.e go back to a search engine and follow a link from there).....☐
Jump to another Web site without using a link.....☐
Follow a link to another Web site.....☐
Close the browser.....☐
N/A, I do no access the Web.....☐

15. Regarding the graphic user interface used on Web sites you visit, what do you find most detracting? (Rank in order, with 1 being most detracting)

Long download times.....☐ Counter intuitive links.....☐ Non-standard link colors.....☐
Long scrolling pages.....☐ Lack of navigation support...☐ Poor color schemes.....☐
Scrolling text, marquees, ads, constantly running animation.....☐

General Web Survey

The following questions are for analytic purposes only. They will not be used to try to identify any individual. However, if you feel uncomfortable about answering any of them do not do so.

	Disagree Strongly		Neither Disagree nor Agree		Agree Strongly
16. I view Web site address as complex and hard to use	1	2	3	4	5
17. Computers make me more productive	1	2	3	4	5
18. Computer increase my workload	1	2	3	4	5
19. Computer reduce paperwork	1	2	3	4	5

20. List 3 Web sites you like and give reasons(s) you like each one (you do not have to use the exact address)

NOTE: If you can not think of 3 sites, please list 3 features you like about Web sites.

21. List 3 Web sites you do **NOT** like and give the reason(s) for each one (you do not have to use the exact address)

NOTE: If you can not think of 3 sites, please list 3 features you do **NOT** like about Web sites.

APPENDIX B. LOG ON PROCEDURES

Welcome to the Aviation Command Safety Assessment (ACSA)

We would like to thank you for participating in this usability analysis. Our goal is to learn how we can improve this web site for the fleet. Your comments will assist in making the ACSA another valuable resource for naval aviation. The survey consists of nine biographical questions and 61 survey questions. We assume you are familiar with basic browser/web site navigation. Due to the length of the survey, this analysis/interview should take roughly 30-45 minutes.

I. Completing the Usability Analysis *HTML* Format

1. **Open your browser of choice to begin**, either Netscape or Internet Explorer.

2. **Enter** the following Internet address ***http://spitfire.avsafety.nps.navy.mil*** to access the ACSA home page.

3. After accessing the ACSA home page, you will be asked to enter a User Name and Password. **Enter** the following:

Use name: Don't
Password: XXXX

The ACSA home page provides general information for the user. Please take a moment to read this page before proceeding.

4. **Select *HTML Survey* to begin.**

5. You should now be viewing a survey form containing Biographical Information and Survey Questionnaire sections. For purposes of this evaluation **answer the Biographical Information questions with your current personal data.**

6. **Answer all Survey Questions from the perspective of your last flying command**. Use the drop-down list-boxes to select your appropriate entry for each question.

II. Submitting your Survey

1. **Click the *SUBMIT*** button at the bottom of the page once. This will open a dialog box requesting your squadron number.

Note: If you made an error completing the form, or forgot to answer a question then the program will alert you to complete the appropriate question. After completing this question re-click the *SUMBIT* button

2. **Type your squadron number** for the squadron number and then click *OK*. This will open another identical dialog box requesting your survey number. ***Your survey number is*** _____

3. **Type your assigned survey number and click *OK*.** If your submission entries were correct, you will see the *Thank You* page, or else you will see a warning page.

III. Viewing Results

The ACSA program provides commanders in the field the opportunity to query the ACSA database. The squadron ASO and CO will have a special password to access this page.

1. **Select Results Applet** to view results. You will get a warning that *Authorization failed.* **Enter** the following:

   User Name: **Commander**
   Password: **XXXXXXXX**

2. To view results:

1. **Select** a question from the drop-down box.

2. **Click** ***SUBMIT***.

Queries can be limited by selecting additional query parameters from the three remaining drop-down boxes. Note the first query takes several (10 – 15) seconds to process over the network, but subsequent queries are much faster.

Thank you for taking the time to complete this survey.

We are interested in your comments!

APPENDIX C.

AVIATION COMMAND SAFETY ASSESSMENT (ACSA) USABILITY SURVEY

Note: Due to formatting differences this survey changed slightly in appearance.

ACSA USABILITY SURVEY

Please read the following before continuing.....

Information gained by this survey will be used in a thesis aimed at creating a better Web interface design for the Aviation Command Safety Assessment (ACSA). Accurate information is essential to developing an accurate profile of indented users. Feedback will also be integrated into the ACSA Web site. The information obtained will also allow us to profile the typical users squadron level. The information obtained in this survey is and will remain anonymous; no names will be taken or associated in any way to the information gained.

This survey should take approximately 20 to 30 minutes to complete.

Thank you for taking the time to participate

Aviation Command Safety Assessment (ACSA) Usability Survey

Please take a few minutes to complete this survey. Your specific answers will be completely anonymous, but your views, in combination with those of others, are extremely important.

Section I - General

Regarding the ACSA Web site, please respond to each of the following:

		Disagree Strongly		Neither Disagree nor Agree		Agree Strongly
1.	Information on the site is relevant	1	2	3	4	5
2.	Information on the site is accurate	1	2	3	4	5
3.	Information on the site is complete	1	2	3	4	5
4.	Information on the site is current	1	2	3	4	5
5.	Information on the site meets my needs	1	2	3	4	5
6.	Information on the site is intuitive	1	2	3	4	5
7.	Information on the site is easily readable	1	2	3	4	5
8.	The site address is too complex	1	2	3	4	5
9.	The amount of page scrolling is acceptable	1	2	3	4	5
10.	The link colors are acceptable	1	2	3	4	5
11.	The colors used throughout the site are acceptable	1	2	3	4	5
12.	The amount of graphics is acceptable	1	2	3	4	5
13.	I would like to see more graphics	1	2	3	4	5
14.	Download times are acceptable (HTML format)	1	2	3	4	5
15.	Download times are acceptable (Java applet)	1	2	3	4	5
16.	Navigation support is acceptable:	1	2	3	4	5
17.	Navigation through the site is intuitive	1	2	3	4	5

Aviation Command Safety Assessment (ACSA) Usability Survey

Please take a few minutes to complete this survey. Your specific answers will be completely anonymous, but your views, in combination with those of others, are extremely important.

Section II - Interactive

Please answer the next set of questions regarding how you feel about each of the following specific matters?

Go to the ACSA Web site located at http://spitfire.avsafety.nps.navy.mil

Web site design/Overall presentation (Please circle one number for each statement)

	Poor	Acceptable	Good	Very Good	Excellent
18. Main page	1	2	3	4	5
19. HTML Survey page	1	2	3	4	5
20. Survey Applet page	1	2	3	4	5
21. Results Applet page	1	2	3	4	5
22. Help page	1	2	3	4	5
23. Secure HTML Survey page	1	2	3	4	5
24. ACSA newsgroup page	1	2	3	4	5

Functionality/Ease of use (Please circle one number for each statement)

	Poor	Acceptable	Good	Very Good	Excellent
25. Instructions on Main page	1	2	3	4	5
26. HTML Survey page	1	2	3	4	5
27. Survey Applet page	1	2	3	4	5
28. Results Applet page	1	2	3	4	5
29. Help page	1	2	3	4	5
30. Secure HTML Survey page	1	2	3	4	5
31. ACSA newsgroup page	1	2	3	4	5

Aviation Command Safety Assessment (ACSA) Usability Survey

Please take a few minutes to complete this survey. Your specific answers will be completely anonymous, but your views, in combination with those of others, are extremely important.

In comparison to the HTML Survey and Survey Applet	Disagree Strongly		Neither Disagree nor Agree		Agree Strongly
32. HTML is easier to use	1	2	3	4	5
33. Applet easier to use	1	2	3	4	5

34. Overall, how satisfied are you with ACSA Web site? (Please circle one number)

Very Dissatisfied	Dissatisfied	Neither Satisfied nor Dissatisfied	Satisfied	Very Satisfied
1	2	3	4	5

APPENDIX D. INTERVIEW QUESTIONS AND SIGNIFICANT RESPONSES

Question: Did you find the portion of the ACSA that you used to be an easy tool for completing the survey?

Responses (HC-3, HC-11 and HSL-45):

- Yes, survey (HTML) was easy to access and easy to complete.
- Yes, very logical and something that will add value to the fleet.
- Yes, great Web site.
- Yes, but why are there two HTML formats?
- Yes, quick to use and easy to submit.
- Yes, I thought it was straight forward and intuitive.
- Yes, super graphics and nice layout.
- No, Java plug-in take to long to load and download times are excessive.
- No, what is a ACSA newsgroup.
- No, Survey Applet won't run right, but HTML format is very nice.

Responses (HC-2, VAW-120 and VAW-123)

- Yes, way to go – look forward to it getting to the squadrons.
- Yes, will make my job easier as Safety Officer.
- Yes, excellent tool to have in my bag of tricks.
- Yes, CO's will fun it.
- Yes, but is my answer's secure.
- Yes, but why the different formats (HTML, Secure HTML, Survey Applet)?
- Yes, nice work on Web site and good graphics.
- Yes, but what happens if there is a power outage while taking the survey?
- No, Survey Applets take too long to load.
- No, Help is very helpful.
- No, too much scrolling – can't reset my screen.
- No, downloading plug-in is a pain in my %#*.

Question: Was there anything that you found particularly difficult to do or understand?

Responses (HC-3, HC-11 and HSL-45):

- Not really
- No, easy to use survey
- No, but I couldn't get Survey Applet to work at first.
- Yes, what is ASCA newsgroups.
- Yes, difference between Secure HTML and HTML survey.
- Yes, help is not a help function.
- Yes, Results applet takes to long to download
- Yes, why do I have navigation buttons to items I will not access in the future (i.e. Results applet, ACSA newsgroup)?
- Yes, how is the data secured?
- Yes, what protects me from someone finding out what my answers are.

Responses (HC-2, VAW-120 and VAW-123)

- No, but the Main page instructions are too technical.
- No, but the help menu is not index to find anything.
- Yes, what is ASCA newsgroup and who uses it.
- Yes, Java plug-in would not load and finally took 30 minutes.
- Yes, what protects me from someone knowing my responses?
- Yes, why is there a Secure HTML survey is it better than HTML survey?

Question: If you could change one thing about the ACSA Web site to make it easier to use, what would it be?

Responses (HC-3, HC-11 and HSL-45):

- Delete the Survey Applet, take too long to load.
- Delete flashing text and waving text in Survey Applet.
- Make the Help function better

- Expand the list of terms.
- Too much scrolling to read information.
- No, easy to use survey
- Survey Applet does not have "select from the following".
- Add Likert scale at the top of each survey
- Flashing titles are annoying
- Options to go back and change selection "Need back button".
- Small type size and too scrolling.

Responses (HC-2, VAW-120 and VAW-123)

- Main page scrolling too fast to read.
- Make statements that answers are will be confidential in open introduction.
- State purpose of survey.
- Applet page should have note to continue with "Tab Questions".
- Need Likert scale at top of page.
- Main page – need statement about "your answers will remain confidential, no attempts will be made to identify you or your organization".
- Help need some type of index.
- Result page – need to select both coast at once.
- Delete loading Java plug-in, what a waste of time.
- Either keep Secure HTML survey or HTML survey, but not both.
- One need one type of survey – HTML works just fine.
- Too much scrolling – make page that fix monitor.

Question: Are there any features you would like to see added to the ACSA Web site?

Responses (HC-3, HC-11 and HSL-45):

- Links to other aviation safety issues.
- Access to Results page by Safety Officer and ASO's.
- A better help feature not just a list of questions answered.

Responses (HC-2, VAW-120 and VAW-123)

- Larger text size.
- Looks great the way it is.
- I like the lay out but scrolling is a problems.

APPENDIX E. SPREADSHEET DATA FOR THE GENERAL WEB SURVEY

GENERAL WEB SURVEY DATA

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Respondent 1	8-10	25-27	F	Navy	O3	H/W/M	PC/IE/MAC	EMAIL/WP/WEB/PG
Respondent 2	8-10	25-27	M	Navy	O3	H/W	PC/N/WIN95/OFF97/NB	EMAIL/WP/WEB/FIN/PG/G
Respondent 3	8-10	25-27	M	Navy	O4	H	PC/IE/WIN95/OFF97/NB	EMAIL/WP/WEB/G
Respondent 4	>12	>33	M	Navy	O5	H/W	PC/N/WIN95	EMAIL/WP/DOD/WEB/FIN
Respondent 5	8-10	25-27	M	Navy	O3	H	PC/N/WIN95/NB	EMAIL/WP/WEB/PG/G
Respondent 6	8-10	<25	M	Navy	O2	H	PC/N/MAC	EMAIL/WP/WEB/DOD/SH/G
Respondent 7	10-12	25-27	F	Navy	O4	H/W/M	PC/ID/WIN95/OFF97	EMAIL/WP/WEB/PG
Respondent 8	10-12	25-27	M	Navy	O4	H	PC/N/WIN95/OFF97	EMAIL/WP/WEB/PG
Respondent 9	8-10	25-27	F	Navy	O3	H/M	PC/N/WIN95	EMAIL/WP/WEB
Respondent 10	>12	>33	M	Navy	O5	H/W	PC/PT/IE/WIN95/OFF95	EMAIL/WP/WEB/PG
Respondent 11	8-10	25-27	M	Navy	O2	H	PC/N/WIN95	EMAIL/WEB/G
Respondent 12	8-10	<25	M	Navy	O2	H	PC/PT/IE/WIN95/NB	EMAIL/WEB/FIN/SH
Respondent 13	10-12	28-30	M	Navy	O2	H/W/M	PC/IE/WIN95	EMAIL/WEB/FIN/SH
Respondent 14	8-10	25-27	M	Navy	O3	H/W	PC/IE/MAC	EMAIL/WEB

PC = Personal computer
Mac = Macintosh
NB = Notebook
PT = Palm Top
Win95/98 = Windows 955/98
N = Netscape
IE = MS Internet Explorer
OFF95 = MS Office 95/97

EMAIL = E-mail
WP = Word Processing
WEB = Web access/browsing
DOD = DoD Application
G = Games
SH = Spread Sheets
FIN = Financial Programs

GENERAL WEB SURVEY DATA

	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19
Respondent 1	NO	Intermed	30-60	Several	0-2	2,3,4,1	1,2,3,4,5,6,7	1	1	3	1
Respondent 2	YES	Novice	0-30	Once	0-2	3,1,2,4	2,3,1,4,6,7,5	2	2	3	3
Respondent 3	NO	Intermed	30-60	Several	2-10	4,3,1,2	1,2,5,3,4,6,7	4	1	3	1
Respondent 4	NO	Intermed	1-3	Several	2-10	4,1,3,2	1,6,5,4,3,7,2	2	2	4	2
Respondent 5	NO	Novice	0-30	Several	2-10	2,1,3,4	3,1,6,2,4,5,7	2	2	2	1
Respondent 6	YES	Intermed	0-30	Once	2-10	3,4,2,1	1,3,5,2,4,6,7	4	1	4	3
Respondent 7	NO	Intermed	0-30	Several	0-2	2,3,4,1	2,3,7,6,1,5,4	2	2	4	1
Respondent 8	NO	Intermed	1-3	Several	2-10	4,2,3,1	1,2,7,4,3,5,6	2	2	3	4
Respondent 9	NO	Novice	0-30	Several	2-10	3,1,2,4	2,3,1,4,5,6,7	2	1	5	1
Respondent 10	YES	Intermed	30-60	Several	2-10	3,1,2,4	1,3,4,2,7,6,5	4	2	2	2
Respondent 11	YES	Expert	0-30	Once	2-10	4,3,2,1	2,1,6,3,4,5,7	2	2	5	1
Respondent 12	NO	Expert	0-30	Several	2-10	2,3,4,1	3,1,2,5,6,7,4	2	3	2	3
Respondent 13	YES	Intermed	30-60	Once	10-30	4,1,2,3	1,2,5,4,3,6,7	2	2	5	1
Respondent 14	NO	Novice	30-60	Once	2-10	3,1,2,4	2,3,4,1,5,6,7	2	3	5	1

Mean	2.36	1.86	3.57	1.79
Median	2.00	2.00	3.50	1.00
Standard Deviation	0.928783	0.6629935	1.157868	1.050902

GENERAL WEB SURVEY DATA

List 3 Web site you like and give reason(s)

HOTBOT - access to good infor
BUPERSnet - potential high for info pertinent to me
ESPN Sports - great info
Snap! News, top stories door - quick, comprehensive info
The Weather Channel - quick, comprehensive info
Zdnet Achor Deck - good access to IT news
NUWCNET - work home page with useful info
ESPNSport.com - nice stories
Dictionary & thesaurus - useful and easy to use
Dilbert - mood lifting, easy
Travel Manger
Business News/Stock quotes
Military home pages
ESPN.com - great site to find current sports info
Dogpile search engine - does everything at once
Alta Vista - go find it
WashingtonPost.com - best news on the Net
DefenseLink.mil - quick info/quick links to related sites
Anchordesk.com - quick info/quick links to related sites
AOL
ESPN Sports - best sports on the web
CNN - latest news
Wired.com - good tech stuff
CNBC - great layout
schwab - investments/trading
picewatch.com - good tech stuff
quicken - stock quotes
ESPN Sports
ABC.com - nice layout
KellyBlueBook - quick, easy to read
Flight Info - easy to use and fast

List 3 Web site you do not like and give reason(s)

Search Engines - low yield
Travel - very hard to find what I want
E-bird - bad scrolling
Broken links
Promise, but no substance
Gratuitous Graphics
Most news sites - Not interactive
IETF.ORG - too technical
Airlines - too much time required
Shopping - Eddie Bauer - too hard, not user friendly
Interlotto.com - too complicated
NY Times - have to subscribe
FlagWeb - not real current
BUPERSnet - potential high, doesn't deliver offen
Flashing notices
Pages that scroll off the page
Text to small to read
Pages that load slow

APPENDIX F. SPREADSHEET DATA FOR THE ASCS SURVEY

ACSA SURVEY DATA

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Respondent 1	4	4	4	5	4	3	2	1	3
Respondent 2	4	5	3	4	3	2	1	3	2
Respondent 3	5	4	4	4	3	3	4	2	3
Respondent 4	2	5	3	3	4	3	2	3	3
Respondent 5	4	4	1	4	3	3	1	2	4
Respondent 6	5	4	4	5	3	4	2	3	3
Respondent 7	4	5	3	3	3	3	3	1	3
Respondent 8	2	4	4	4	4	3	2	2	3
Respondent 9	4	4	3	4	4	4	1	3	3
Respondent 10	4	3	4	4	4	3	2	2	2
Respondent 11	5	4	4	5	3	3	2	3	4
Respondent 12	4	3	3	4	4	2	2	3	3
Respondent 13	4	4	4	4	4	3	2	3	3
Respondent 14	3	4	4	3	4	3	2	2	3
Respondent 15	4	4	4	4	4	4	2	3	3
Respondent 16	4	4	5	4	4	4	3	3	5
Respondent 17	4	5	4	3	4	3	2	2	3
Respondent 18	3	5	4	4	4	5	4	1	5

Mean	3.83	4.17	3.61	3.94	3.67	3.22	2.17	2.33	3.22
Median	4.00	4.00	4.00	4.00	4.00	3.00	2.00	2.50	3.00
Standard Deviation	0.8574929	0.618347	0.849837	0.639137	0.485071	0.732084	0.85749	0.766965	0.808452

ACSA SURVEY DATA

	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18
Respondent 1	4	4	3	1	5	3	4	4	5
Respondent 2	4	4	2	4	4	1	4	5	3
Respondent 3	5	5	4	3	4	2	2	4	5
Respondent 4	3	4	4	3	5	1	3	5	4
Respondent 5	4	4	1	4	4	2	4	4	3
Respondent 6	5	5	3	3	5	2	4	5	5
Respondent 7	4	4	4	3	4	1	3	4	4
Respondent 8	4	4	3	4	4	2	4	4	3
Respondent 9	5	5	4	3	5	1	4	4	4
Respondent 10	3	4	3	3	4	2	4	4	4
Respondent 11	4	4	3	3	5	1	2	4	3
Respondent 12	5	5	3	3	5	1	4	4	4
Respondent 13	4	4	4	2	4	1	3	4	4
Respondent 14	4	4	3	2	5	2	4	4	3
Respondent 15	4	4	1	2	4	1	3	4	5
Respondent 16	5	5	3	3	5	2	4	5	4
Respondent 17	4	4	3	1	4	1	2	5	4
Respondent 18	5	5	5	3	5	3	4	5	3

Mean	4.22	4.33	3.11	2.78	4.50	1.61	3.44	4.33	3.89
Median	4.00	4.00	3.00	3.00	4.50	1.50	4.00	4.00	4.00
Standard Deviation	0.646762	0.485071	1.02262	0.878204	0.514496	0.697802	0.783823	0.485071	0.758395

ACSA SURVEY DATA

	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27
Respondent 1	4	4	-	2	-	-	2	4	3
Respondent 2	2	1	-	3	-	-	2	5	2
Respondent 3	4	4	4	2	-	-	4	4	2
Respondent 4	5	1	3	3	-	1	1	4	2
Respondent 5	4	3	-	2	1	1	2	4	3
Respondent 6	2	4	3	1	-	-	2	3	2
Respondent 7	4	1	2	2	2	2	4	4	2
Respondent 8	2	3	-	2	3	1	2	3	2
Respondent 9	4	4	4	1	-	-	2	4	3
Respondent 10	4	4	3	2	-	-	1	4	3
Respondent 11	4	3	-	2	-	-	2	5	2
Respondent 12	3	4	3	2	-	-	3	4	3
Respondent 13	4	1	-	2	2	1	2	4	2
Respondent 14	4	3	3	2	3	3	1	5	2
Respondent 15	3	2	3	1	-	-	2	4	3
Respondent 16	4	4	-	2	2	1	1	5	2
Respondent 17	5	3	-	1	-	-	2	4	2
Respondent 18	5	1	3	2	-	-	3	5	2

Mean	3.72	2.78	3.10	1.89	2.17	1.43	2.11	4.17	2.33
Median	4.00	3.00	3.00	2.00	2.00	1.00	2.00	4.00	2.00
Standard Deviation	0.95828	1.26284	0.5676	0.583	0.752773	0.786796	0.900254	0.618347	0.485071

ACSA SURVEY DATA

	Q28	Q29	Q30	Q31	Q32	Q33	Q34
Respondent 1	-	4	-	-	4	2	5
Respondent 2	-	4	-	-	4	2	4
Respondent 3	4	4	-	-	4	2	3
Respondent 4	4	3	-	-	5	2	4
Respondent 5	-	4	1	1	3	2	5
Respondent 6	4	3	-	-	4	5	4
Respondent 7	4	3	2	1	5	2	5
Respondent 8	-	3	3	1	4	3	4
Respondent 9	4	3	-	-	5	3	5
Respondent 10	4	4	-	-	4	2	5
Respondent 11	-	4	-	-	4	2	4
Respondent 12	4	3	-	-	4	3	5
Respondent 13	-	3	2	2	5	2	5
Respondent 14	3	3	3	1	4	2	5
Respondent 15	3	4	-	-	4	2	3
Respondent 16	-	3	2	2	4	3	4
Respondent 17	-	4	-	-	4	2	5
Respondent 18	3	3	-	-	3	5	4

Mean	3.70	3.44	2.17	1.33	4.11	2.56	4.39
Median	4.00	3.00	2.00	1.00	4.00	2.00	4.50
Standard Deviation	0.483046	0.51131	0.752773	0.516398	0.582983	0.983524	0.697802

LIST OF REFERENCES

Andrews, Whit. "The Frame Tag: A Bit of a Bust, for Now," Web Week 2, 7, June 3, 1996. http://www.internetworld.com/print/1996/06/03/news/frame.html

Bellcore (1994, December). *Guide for Multi-platform Graphical User Interfaces.* LP-R13, Issue 2, December 1994. Piscataway, NJ: Bell Communications Research, Inc. (1-800-521-CORE).

Ciavarelli, Anthony and Figlock, Robert. "Organizational Factors in Aviation Accidents," August 1996, http://web.nps.navy.mil/~avsafety/research/orgfacts.htm

Flavell, A., *Use of Alt text in Imgs*, Glasgow University, August 14, 1998 (Revised), http://ppewww.ph.gla.ac.uk/~flavell/alt/alt-text.html

Fowler, Floyd, J., Jr. (1995). Improving survey questions : Design and evaluation. Thousand Oaks, CA: Sage Publications.

Gahran, Amy. (1998a), "Cut the Fluff!" Contentious Web-zine, April 6, 1998, www.contentious.com/articles/1-1/cip1-1/cip1-1.html

Gahran, Amy. (1998b), "Interview with Jakob Nielsen, Part 1," Contentious Web-zine, August 5, 1998, http://www.contentious.com/articles/1-5/qa1-5a.html

Gillespie, Joe. (1998), "Web Page Design-For Designers," May 5, 1998, http://www.wpdfd.com/wpdhome.htm

Hertzberg, Robert. "Jumpin' Jehoshaphat," Web Week 2, 13, September 9, 1996, http://www.internetworld.com/print/1996/09/09/opinion/editor.html

Lie, Håkon, and Bert Bos. "Cascading Style Sheets, Level 1," World Wide Web Journal, November 12, 1996 and at http://www.w3.org/pub/WWW/TR/PR-CSS1-961112

Held, Jonathan and Mingo, Fred, *Automating the Aviation Command Safety Assessment Survey as an Enterprise Information System (EIS)*, Master's Thesis, Naval Postgraduate School, Monterey, California, March 1999.

Nielsen, J., Galdo, E. M. d., Sprung, R. C., and Sukaviriya, P. N. (1990). *Designing for International Use.* In Proceedings of ACM CHI '90 Conference on Human Factors in Computing Systems (pp. 291-294).

Nielsen, Jakob. (1994) Usability Engineering, Boston: Academic Press, 1994. (Table of contents at http://www.useit.com/jakob/useengbook.html

Nielsen, Jakob. (1996a), "Inverted Pyramids in Cyberspace, Alerbox, June 1997, www.useit.com/alertbox/9606.html

Nielsen, Jakob. (1996b), "Top Ten Mistakes in Web Design, Alerbox, May 1996, www.useit.com/alertbox/9605.html

Nielsen, Jakob. (1997a), "How Users Read on the Web," Alerbox, October 1997, www.useit.com/alertbox/9703a.html

Nielsen, Jakob. (1997b), "Why Web Users Scan Instead of Read," Alerbox Sidebar, October 1997, www.useit.com/alertbox/whyscanning.html

Nielsen, Jakob. (1997c) "Interface Design for Sun's WWW Site," http://www.sun.com/sun-on-net/uidesign/

Nielsen, Jakob. "Guidelines for Multimedia on the Web," Sun Microsystem's Alert Box for December 1995, included in this issue of the World Wide Web Journal and at http://www.sun.com/951201/columns/alertbox/

Nielsen Norman Group, *User Experience*, Definition from Nielsen Norman Group Web sit, http://www.nngroup.com/about/userexperience.html

Mullet, K., and Sano, D. Designing Visual Interfaces - Communication Oriented Techniques. Englewood Cliffs, NJ: Prentice Hall 1995.

Paciello, Michael. "People with Disabilities Can't Access the Web!" in this issue of the World Wide Web Journal, 1997, http://www.w3j.com/5/s3.paciello.html

Salasoo, A., White, E., Dayton, T., Burkhart, B., and Root, R. (1994). "Bellcore's User Centered Design Approach". In M. Wilkind (Ed.), Usability in Practice. Boston: Academic Press

Sano, Darrell. Designing Large-Scale Web Sites: A Visual Design Methodology, New York: John Wiley & Sons, 1996. (Table of contents at http://www.wiley.com /resrch.cgi

Williams, Margot. (The Washington Post), *A Primer for a good Web page*, Seattle Times Company, March 29, 1998, www.seattletimes.com/news/technology/html98/issu_032998.html

BIBLIOGRAPHY

Andrews, Whit. "The Frame Tag: A Bit of a Bust, for Now," Web Week 2, 7, June 3, 1996. http://www.internetworld.com/print/1996/06/03/news/frame.html

Bellcore (1994, December). *Guide for Multi-platform Graphical User Interfaces.* LP-R13, Issue 2, December 1994. Piscataway, NJ: Bell Communications Research, Inc. (1-800-521-CORE).

Ciavarelli, Anthony and Figlock, Robert. "Organizational Factors in Aviation Accidents," August 1996, http://web.nps.navy.mil/~avsafety/research/orgfacts.htm

Flavell, A., *Use of Alt text in Imgs*, Glasgow University, August 14, 1998 (Revised), http://ppewww.ph.gla.ac.uk/~flavell/alt/alt-text.html

Fowler, Floyd, J., Jr. (1995). Improving survey questions : Design and evaluation. Thousand Oaks, CA: Sage Publications.

Gahran, Amy. (1998a), "Cut the Fluff!" Contentious Web-zine, April 6, 1998, http://www.contentious.com/articles/1-1/cip1-1.html

Gahran, Amy. (1998b), "Interview with Jakob Nielsen, Part 1," Contentious Web-zine, August 5, 1998, http://www.contentious.com/articles/1-5/qa1-5a.html

Gillespie, Joe. (1998), "Web Page Design-For Designers," May 5, 1998, http://www.wpdfd.com/wpdhome.htm

Gilmore, Walter, and Gertman, David, User-Computer Interface in Process Control, Boston: Academic Press, 1989.

Hertzberg, Robert. "Jumpin' Jehoshaphat," Web Week 2, 13, September 9, 1996. http://www.internetworld.com/print/1996/09/09/opinion/editor.html

Karat, John, Taking Software Design Seriously, Boston, MA: Academic Press, 1991.

Levi, Michael D., and Conrad, Frederick G., *Usability Testing of World Wide Web Sites*, May 7, 1998, http://stats.bls.gov/ore/htm_papers/st960150.html

Lie, Håkon, and Bert Bos. "Cascading Style Sheets, Level 1," World Wide Web Journal, November 12, 1996, http://www.w3.org/pub/WWW/TR/PR-CSS1-961112

Held, Jonathan and Mingo, Fred, *Automating the Aviation Command Safety Assessment Survey as an Enterprise Information System (EIS)*, Master's Thesis, Naval Postgraduate School, Monterey, California, March 1999.

Miller, Richard H., *Web Interface Design: Learning from our Past*, Bell Communication Research, July 3, 1998, http://www.cs.rutgers.edu/~shklar/www4/miller/rhmpaper.html

Nielsen, J., Galdo, E. M. d., Sprung, R. C., and Sukaviriya, P. N. (1990). *Designing for International Use.* In Proceedings of ACM CHI '90 Conference on Human Factors in Computing Systems (pp. 291-294).

Nielsen, Jakob. (1994) Usability Engineering, Boston, MA: Academic Press, 1994. (Table of contents at http://www.useit.com/jakob/useengbook.html

Nielsen, Jakob. (1996a), *Inverted Pyramids in Cyberspace*, Alerbox, June 1997, www.useit.com/alertbox/9606.html

Nielsen, Jakob. (1996b), *Top Ten Mistakes in Web Design*, Alerbox, May 1996, www.useit.com/alertbox/9605.html

Nielsen, Jakob. (1997a), *How Users Read on the Web*, Alerbox, October 1997, www.useit.com/alertbox/9703a.html

Nielsen, Jakob. (1997b), Why Web Users Scan Instead of Read, Alerbox Sidebar, October 1997, www.useit.com/alertbox/whyscanning.html

Nielsen, Jakob. (1997c) *Interface Design for Sun's WWW Site*, Sun on the Net, http://www.sun.com/sun-on-net/uidesign/

Nielsen, Jakob. *Guidelines for Multimedia on the Web*, Sun Microsystem's Alert Box for December 1995, included in this issue of the World Wide Web Journal and at http://www.sun.com/951201/columns/alertbox/

Nielsen Norman Group, *User Experience*, Definition from Nielsen Norman Group Web sit, October, 1998, http://www.nngroup.com/about/userexperience.html

Mayhew, Dehorah, Principles and Guidelines in Software User Interface Design, Englewood Cliffs, NJ: Prentice Hall, 1992

Mullet, K., and Sano, D. Designing Visual Interfaces - Communication Oriented Techniques. Englewood Cliffs, NJ: Prentice Hall 1995

Paciello, Michael. "People with Disabilities Can't Access the Web!" in this issue of the World Wide Web Journal, 1997, http://www.w3j.com/5/s3.paciello.html

Rozelle, Daniel, "A Methodology for Improving the Usability of the ANVIS/HUD Computer Based Trainer," Master's Thesis, Naval Postgraduate School, Monterey, California, March 1997.

Salasoo, A., White, E., Dayton, T., Burkhart, B., and Root, R. (1994). Bellcore's User Centered Design Approach. In M. Wilkind (Ed.), Usability in Practice. Boston: Academic Press

Sano, Darrell. Designing Large-Scale Web Sites: A Visual Design Methodology, New York: John Wiley & Sons, 1996. (Table of contents at http://www.wiley.com /resrch.cgi

Shneiderman, Ben, Designing the User Interface, Reading, MA: Addison-Wesley, 1998.

Shubin, Hal, *Navigation in Web Applications*, Interaction Design, August 24, 1998, www.user.com/webapps/webapps.htm

Williams, Margot. (The Washington Post), A Primer for a good Web page, Seattle Times Company, March 29, 1998, www.seattletimes.com/news/technology/html98/issu_032998.html

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center 2
   8725 John J. Kingman Road, Ste 0944
   Fort Belvoir, VA 22060-6218

2. Dudley Knox Library 2
   Naval Postgraduate School
   411 Dyer Road
   Monterey, California 93943-5101

3. Dr. Anthony Ciavarelli, Code 10 1
   Aviation Safety Program
   Naval Postgraduate School
   Monterey, CA 93943-5101

4. Kishore Sengupta 1
   Department of Systems Management
   Naval Postgraduate School
   Monterey, CA 93943-5101

5. LCDR Thomas G. Williams 3
   2508 Dehart Court
   Virginia Beach, Virginia 23456